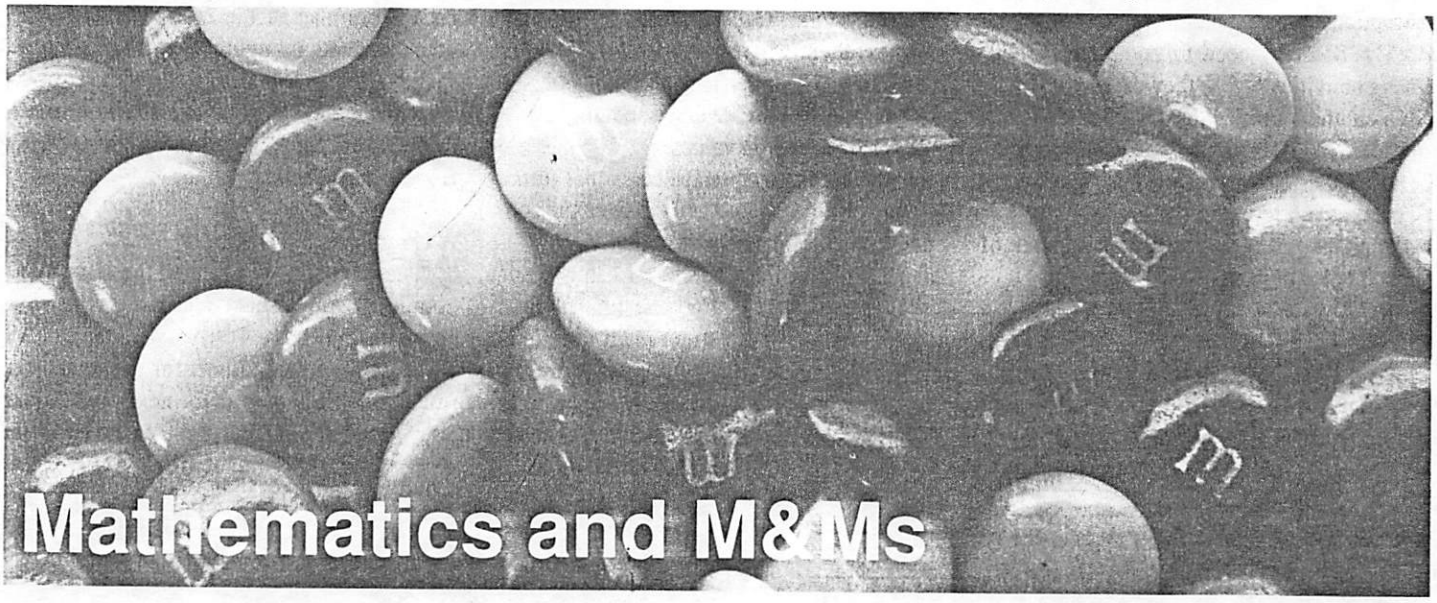

Mathematics and M&Ms

by Margaret L. Niess

An old "staple" in mathematics classes introduces spreadsheets with graphing capabilities as tools for mathematics investigations.

Teaching mathematics with calculators, computers and other technologies is exciting and challenging. Not many of us learned mathematics with the use of these new tools. Therefore, it is important that we share our ideas. Let's write an article together! Send me your ideas for teaching mathematics. Together, we will create a "sampler" of ideas to share with all the readers. Everyone will benefit from the ideas—especially the students!

Mm mm good, an edible manipulative for the mathematics classroom that melts in your mouth and not in your hands! That's right, M&Ms are useful in many ways in the mathematics classroom. How many M&Ms are in a typical bag? How many different colors of M&Ms are in a typical bag? What is the fraction of red M&Ms? What is the percent of green M&Ms? What decimal part of the whole bag do the yellow M&Ms comprise? These questions are but a few of the many possible questions for students to consider.

The beginning of a new school year is a time to refresh the students' memories and to instruct them in the use of some of the tools they will be using throughout the year. The spreadsheet with a graphing option is a valuable tool for the mathematics classroom. Here is an activity that I have used many times to introduce students to the idea of a spreadsheet. The activity does require that each student has a bag of M&Ms.

Warm-up

Find out what the students know about a bag of M&Ms. Accept their responses without saying "Right" or "Wrong." When students open their own bag, they can adjust the responses.

What is in a typical bag? (M&M candies.) Can you be more specific? (They are round candies with an M on them.) Do they all look exactly alike? (No, there are different colors of candy.) How many different colors? (Answers typically vary from five to seven.) What are the colors? (Red, yellow, green, orange, tan, and brown are the colors.) Are there the same number of each color in a bag? (No.) Which color has the most? (Let them guess.) How many total M&Ms are in a typical bag? Record all responses.

To clarify the responses, open a sample bag of M&Ms and demonstrate what the students will be doing with their bag. Place a transparency on the overhead, pour the candies on the sheet, and form a histogram with the candies as in Figure 1: (M&Ms do melt so don't leave the overhead light on for the whole class period!) Ask students to count the numbers of each color and find the total number of M&Ms in the bag. Compare these numbers with the student guesses.

Data Collection

Students are now prepared to estimate the

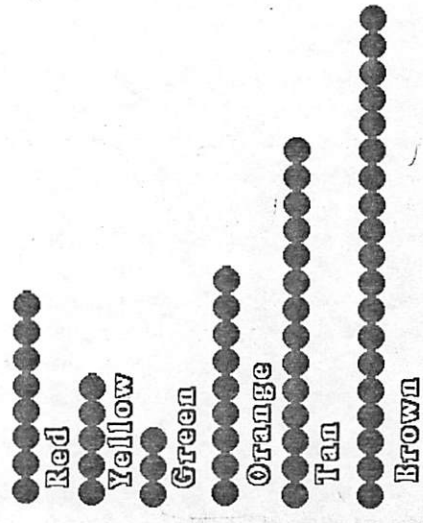

Figure 1. Sample candy histogram.

numbers of each color and the total number for their own bags of M&Ms. Have students record their estimates (guesses based on information from the warm-up) on a record sheet similar to Figure 2. Be sure to give clear instructions before handing out the bags of M&Ms. Students need to complete the following activities *before* they eat the data.

1. Open the bag of M&Ms on a sheet of paper.
2. Move the M&Ms to form a candy histogram as in Figure 1.
3. Count and record the actual number of each color of M&Ms.

Color	Guess	Actual	Actual-Guess
Red			
Yellow			
Green			
Orange			
Tan			
Brown			
Total			

Figure 2. Sample data collection sheet.

4. Record the total number of M&Ms.
5. Using six 3X5 cards, record the number of each color on a separate card. Make the number large and dark. On the reverse side of the card record the corresponding color for that number.
6. Using one more 3X5 card, write the student name in large, dark letters.
7. Complete the record sheet by finding the difference between your guess and the actual number found in the bag. This difference might be negative.

A "Floor" Spreadsheet

When all students have finished, a "floor" spreadsheet is used to display the class data. Place column (marked A, B, C, D, E, F, G,H,I) and row (1, 2, 3, 4, 5,...) identifiers (two more than the number of students in your class) made out of 3X5 cards on the floor marking out the area for the spreadsheet. Next, place labels for each of the columns that you will use, naming the cells as you store the information (see Figure 3). Instruct the students to place their records of information in particular rows (assign the rows to ease congestion around the spreadsheet).

After all data records have been entered into the spreadsheet, have the students find the cell that contains:

- the least number of green M&Ms (D4).
- the most number of red M&Ms.(B5).
- the least number of orange M&Ms (E3).

Next consider the differences between *labels* and *values*. Cells D4, B5, and E3 have values in them whereas cells A2, A3, and A4 have labels. The spreadsheet cannot add, subtract, multiply or divide labels, but the spreadsheet can operate on values.

One value of the spreadsheet is that formulas may be entered into cells to have the computer compute other values. Cell H1 has the label Total. Ask the students how they would find the total, but instruct them to tell you by referring to the cell names. In the example, Pat's total is determined by "adding the values in cells B2, C2, D2, E2, F2, and G2." As the formula is identified, write the equivalent formula, (B2+C2+D2+E2+F2+G2), for the spreadsheet on a 3X5 card and place the card in cell H2. Provide the students with the spreadsheet shortcut for this formula (for Microsoft *Works* on Macintosh, =SUM(B2:G2) and for *AppleWorks*, =SUM(B2...G2)). Have each student prepare a formula on a 3X5 card and place it in the appropriate cell in the spreadsheet. They should also act as the computer and prepare a card with the actual value, placing that card over the formula in the same cell.

As suggested by the label in cell A6, the next problem is to find the average number of M&Ms for each color. Ask the students how they would compute the average for the num (B2:B5). Assign students to place the appropriate formulas in the cells, and then have other students compute the value using the formula. When this task is completed, review the concepts of labels, values, and formulas referring to the specific information in the floor spreadsheets.

A Computer Spreadsheet

The next task is to enter the data into a computer spreadsheet similar to the floor spreadsheet (Figure 4). To assist in this task, I copy the floor spreadsheet for the students to use at their computers at the next class period; copy only the student data, not the values determined by formulas. Instruct students to enter the formulas, as they did for the floor spreadsheet. Experience with the floor spreadsheet simplifies this activity.

Demonstrate the use of the graphing tools to have the computer create a histogram of the average bag of M&Ms using the data in the spreadsheet (Figure 5). If you are using *AppleWorks*, you'll need an add-on graphing package such as *TimeOut Graph* from Beagle Bros. Challenge the students to create a histogram that compares the average bag of M&Ms with their personal data.

An excellent completion to the M&Ms activity is to have the students prepare a report using a word processor, copying the data and the graph into the report. For the report, students describe the experi-

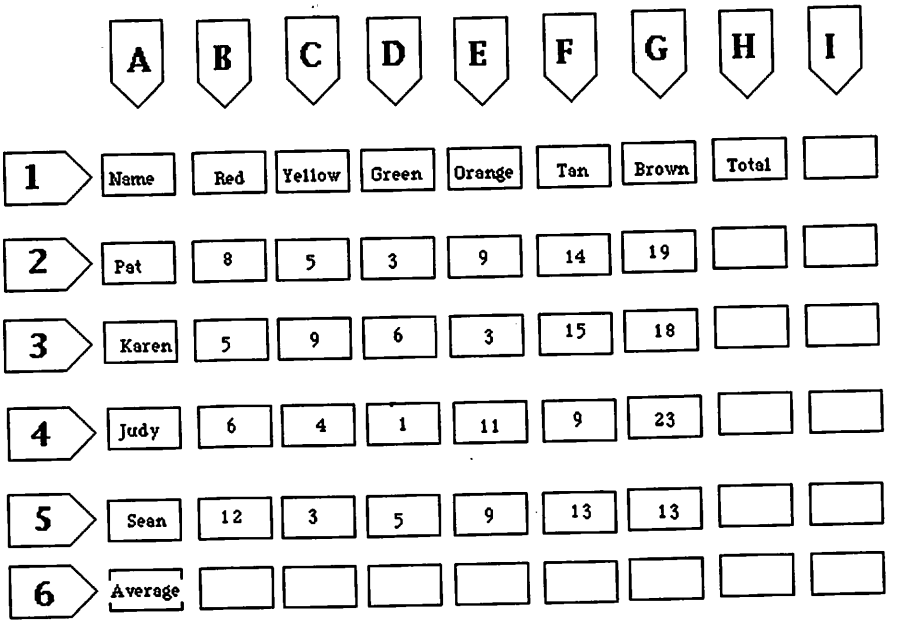

Figure 3. Sample floor spreadsheet.

	A	B	C	D	E	F	G	H
1	Name	Red	Yellow	Green	Orange	Tan	Brown	Total
2	Pat	8	5	3	9	14	19	58
3	Karen	5	9	6	3	15	18	56
4	Judy	6	4	1	11	9	23	54
5	Sean	12	3	5	9	13	13	55
6	Average	8	5	4	8	13	18	56

Figure 4. Completed MSWorks spreadsheet.

ment that was conducted and show the results, including the data and histograms. In the summary, they must respond to the following questions. From this sample of M&Ms:

- Which color(s) appear least?
- Which color(s) appear most?
- What is the ratio of red:yellow:green: orange:tan:brown M&Ms in an average bag?
- Based on this sample, if a bag of M&Ms contains 100 M&Ms, how many reds are expected? How many yellows? How many greens? How many oranges? How many tans? How many browns?

Summary

According to the National Council of Teachers of Mathematics (NCTM) *Curriculum and Evaluation Standards for School Mathematics* (1989), students should learn to use the computer as a tool for processing information and performing calculations to investigate and solve problems. And, as indicated in the NCTM (1991) *Professional Standards for Teaching Mathematics*, teachers not only need to use technology to perform mathematical investigations, but they need to help students do the same. The beginning of the school year is the best time to begin experiences in learning to use tools such as the spreadsheet. M&Ms provide a "rich" environment for students to systematically collect, organize, and describe data using the appropriate tool, the computer. The floor spreadsheet provides a natural transition for students to learn about the computer spreadsheet. Learning to use the tool and using the tool to pursue mathematical investigations can and should be continued throughout the year.

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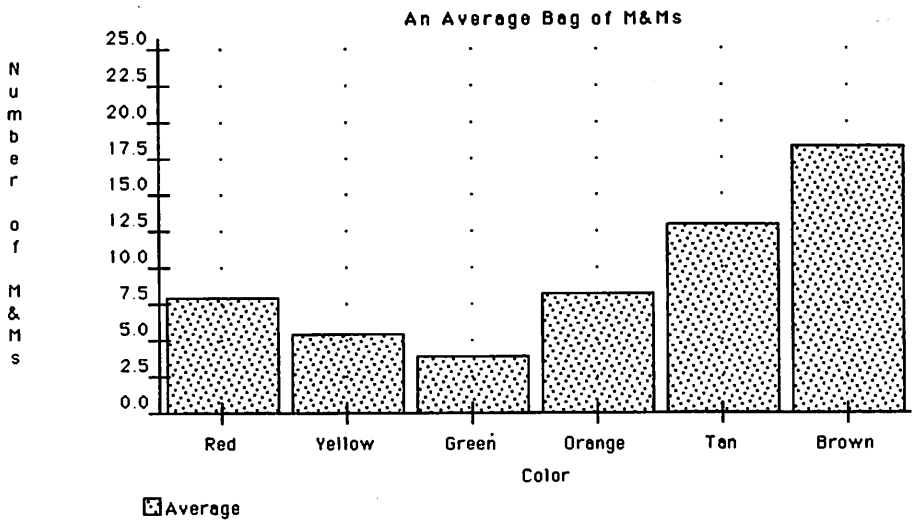

Figure 5. MSWorks histogram.

Systemic Change: Rethinking the Purpose of School

Tony Wagner

Systemic reflection, not reflexive reaction, is fundamental to long-term improvement. Schools and districts must first ask the right questions.

That there are so few examples of sustained, systemic change in our nation's schools should not come as a great surprise. We have had little real incentive to rethink the purposes of education since the Industrial Revolution, when schools had to be redesigned to prepare a largely immigrant labor force for new forms of work and citizenship.

Now, in another era of rapid economic and social transformation, the business world finds that it must adapt to new technologies, changing markets, and global competition. This new revolution in the workplace, in turn, suggests fundamental reforms for education. In fact, many school critics are proclaiming that business has all the answers for schools. The same was said at the turn of the century when new industrial practices—notably Frederick Taylor's principles of "scientific management"—pointed the way for the development of now obsolete "factory" schools.

Education for new forms of work is a necessary but insufficient reason for undertaking systemic change. Educators must also consider the competencies required for active citizenship as well as changes in both students' capacities and incentives for learning. Profound and ongoing changes in the workplace, in the requirements for global citizenship, in the nature of knowledge, and above all, in the needs and concerns of our students—all of these must be taken into account. Such "systemic" reflection—rather than reflexive reaction to outsiders' demands—should be the starting point for developing an *educators'* methodology for improving schools.

But before considering how to encourage thoughtful community discussions about purposes that will lead to systemic changes, let's look at some of the limitations of business models for restructuring schools.

Corporate Models and Education

Recently, superintendents and community leaders have turned to the ideas of Deming, Senge, and others in their search for a methodology for systemic change. Looking for answers outside one's organization was also the first step that some corporations took more than a decade ago. Then—as now in schools—a variety of new theories were quickly imported: Quality Circles from Japan, the team alternative to the assembly line from Volvo in Sweden. Some ideas and models truly pointed to new "best practices," but others proved ineffective or had to be modified substantially to work in American companies.

While we can learn much from business models for change, we must not forget that the most successful "locally grown" efforts have been substantially refined through years of R&D. For example, it has taken Ford 12 years to develop and implement design and manufacturing changes that only recently have resulted in such significant payoffs as the Taurus beating out Honda's Accord for the number-one slot in American car sales.

Efforts to apply corporate models to educational change risk failure, in my experience, when the differences between businesses and schools are not clearly understood. The task of creating consensus on the need for and the goals of change—as well as new incentives for risk taking—are much more complicated in schools. Because corporations can see the problems and relatively quickly measure the effects of change efforts through a variety of quantitative measures—improved quality, profit, and market share—there is rarely disagreement about goals. Likewise, better numbers become obvious incentives.

In communities, however, there is little agreement about the goals of school reform or how improvements might best be measured. My interviews with parents, business leaders, educators, and students in a variety of communities reveal strikingly different views. For a lot of parents, the problem is getting test scores up and their kids into good colleges and solid careers. For some business leaders, it's making sure kids have basic skills; others want to produce a world-class work force. For many educators, the problem is simply getting kids to have more respect for learning and authority and to do some homework.

Rarely are students asked what they think the problems are in their schools. While some of the TQM and other change literature may refer to students as "customers," most educators still act as though vocal parents, standardized test makers, and college admissions committees are the customers that matter the most. Students are much more frequently thought of as the recalcitrant "raw

material" from which quality products must be fashioned.

Unlike steel, however, students must be motivated to improve. Ask many middle and high school-age students what's wrong with their schools—as a group from the Institute for Education in Transformation at The Claremont Graduate School recently did—and they will tell you. Schools "hurt their spirit," classes are boring and irrelevant to their lives, and people seem cold and uncaring.[1]

How can we motivate teachers and students to change—and parents or community members to support long-term change—if we can't agree on what the problems are? Even the most thoughtful reform efforts—such as those represented by a few schools in the Coalition of Essential Schools—frequently run into trouble in their communities after a year or two because they began with surface answers—like "student-as-worker" and "teacher-as-coach"—rather than thoughtful discussions about why change is necessary.

Business models as applied to schools lack a methodology for creating consensus about the goals for meaningful reform. While their focus is "systemic," the outcomes are expert- or theory-driven solutions to problems that are not broadly understood. And all too often, these new ideas and practices are imposed from above, with little—if any—discussion among the people most affected: teachers, parents, students, and community members. Without broad agreement about the kinds of changes needed and why, these "systemic" efforts are no more likely to succeed than so many other educational innovations we've seen come and go.

The Right Questions

The real challenge in developing a methodology for school reform is not as abstract or mystical as the corporate change literature makes it seem. The problem is—first and foremost—an educational one: how to create conditions that will promote informed, thoughtful discussion about purposes among teachers, students, parents, and community members. For example, what's right—and what's wrong—with our schools? What should the goals of school improvement efforts be?

While the search for answers and the struggle to implement them is indeed difficult and time-consuming, the real methodology for system change begins and ends with ongoing, authentic conversations about the important questions. My work as a consultant for school improvement over the past four years points to five essential questions:

1. What are our schools' strengths and weaknesses?
2. What is our vision and what are our core values for a better school?
3. What are our priorities and strategies for change?
4. What structures do we need to reach our goals?
5. What new skills and resources will we need?

The real methodology for system change begins and ends with ongoing, authentic conversations about the important questions.

What Are Our Strengths and Weaknesses?

Individual schools—or even entire districts—need to take an honest look at what is and isn't working in their schools. Too often that assessment begins and ends with a look at numbers—test scores and dropout rates, and perhaps a parent survey. Rarely, if ever, are teachers and students polled.

Even if students and teachers are consulted, the "numbers approach" to a school needs assessment tells us nothing about how individuals think about problems or their ideas for solving them. Numbers cannot capture people's thinking about *why* there's a high dropout rate, for example, or what ideas they might have for improvements.

Numbers are also misleading. Too many wealthy suburban schools today aren't considering any kind of systemic changes because their test scores and college admission rates are OK. But these indicators tell us nothing about the *quality* of students' work or their lives. As long as kids continue to get into good colleges, school officials in many "good" districts don't consider high student anxiety and boredom in school and increasing substance abuse "after hours" to be evidence of a need for change.

Just as a growing number of businesses and political parties have done, so must schools begin to use qualitative research to understand what and how people think. Focus groups have been used successfully for years by

organizations like The Public Agenda Foundation (founded by polling analyst Daniel Yankelovich and former Secretary of State Cyrus Vance) to understand people's thinking about complex social problems and policy questions. The results of focus groups are a far better indicator of individuals' deepest concerns and priorities for change. Even more important, focus groups led by skilled moderators can introduce new ways of viewing a problem and determine whether or not different groups can then see change in a new light. This latter application is critical for the school change process.

As communities begin to discuss how schools need to change, they must first consider the ways in which our society has changed over the past quarter century. Focus groups can explore how various people see the problems in schools and also present data that will clarify the need for change. It is far easier to develop consensus for educational change among different groups when they are presented with a common framework for viewing the issues.

What are some elements of such a framework? First, we must understand how rapid technological, economic, and social changes have radically altered the skills needed for productive work, active citizenship, application of knowledge, and development of good habits for personal growth and health. Then, we must consider how *students* have changed. Raised in a consumer- and work-obsessed society with less connection to caring adults, many young people seem emotionally needy, hungry for instant gratification, and addicted to passive forms of entertainment. Compared to previous generations, they are less hopeful about the future and less motivated by traditional incentives for learning—respect for authority and belief that hard work will get you where you want to go. It is only by first coming to agreement on ways in which the world and students' needs have changed that we can conceive *a common framework for rethinking the purposes of education.*[2]

Serious efforts for systemic change in schools should begin with a series

Students won't learn and teachers won't collaborate if they don't feel respected. Change involves the heart as well as the head.

of focus group sessions with present and prospective parents, business and community leaders, educators, and present and former students. Topics should center around our schools' strengths, weaknesses, and priorities for change in light of society's evolving educational needs and priorities. The results should then be presented and discussed in "Town Meetings for Learning," where mixed groups try to understand and work through areas of disagreement. The goal is to create a public mandate for change that is sustainable.

I recently conducted a series of two-hour focused discussions in a community where there were some surprising findings—as well as significant rewards—for the courageous team of high school teachers and administrators who sponsored them. One finding was that community members and parents did *not* blame teachers for the problems in schools; rather, they saw teachers as caring people and felt that our society as a whole should assume responsibility for improving education.

Second, after reflecting on the challenges of preparing students for the 21st century, community members were more prepared to support profound curriculum changes than teachers had assumed—including a greater focus on competencies, rather than coverage; more interdisciplinary and team teaching; and the development of alternative forms of assessment.

Focus group work with students revealed that they, too, want to take more responsibility for their learning. They also want a school climate that actively nurtures greater respect for students and adults alike, as well as closer informal "advisor" relationships between teachers and students.

Finally, the focus group process contributed to an increased sense of trust and respect for educators in the community. *Everyone* appreciated the invitation to become more involved—and the opportunity to have a voice.

All these findings formed a foundation for answering the second essential question of systemic change.

What Is Our Vision for a Better School?

An honest discussion of real problems in schools is the "stick" of educational change. But without a "carrot," teachers will lack the morale and the incentives for risk taking. Communities need to agree on an inspiring vision to drive the change process.

Through holding Town Meetings for Learning and then creating working task forces around specific skill and subject areas, communities can begin the hard work of coming to agreement on goals for change. Developing a vision means finding new answers to age-old questions: What does it mean to be an educated person today? What should students know and be able to do in order to graduate from high school? How do we best prepare our students for the future?

Lofty-sounding mission statements routinely adorn schools' conference rooms and superintendents' offices. But if a mission statement is to be a true road map for change, it must be both broadly understood and translated into explicit criteria for assessing results. When small committees of educators and parents develop statements about teaching "critical thinking" or "citizenship skills," for example, nothing really changes. It is quite a different process for an entire community to define skills in terms of specific outcomes—such as the ability of students to analyze opposing editorials on an important issue and then write one of their own, for example. Creating a vision of a better school must include definitions of real outcomes and discussion of how they can best be assessed.

Core values are an essential aspect of a vision for a better school. Improving the quality of life and relationships in individual schools may be

as important as redefining the goals in the change process. Students won't learn and teachers won't collaborate if they don't feel respected. In other words, change involves the heart as well as the head. While a vision statement clarifies the desired outcomes of change, core values define how we treat one another—and what kind of people we aspire to be—in the process. Together, they become the collective mission of the school community and the basis for designing and evaluating the change process.

In one school where a successful systemic change effort had been in place for several years, I facilitated a series of focus groups with faculty, students, and then parents. We began with questions like: What behaviors are of greatest concern to you here at school? What behaviors would you like to see more of? Within three months, the school community agreed on the following values as their guiding principles: honesty, respect for self and others, responsibility, and citizenship. With a common framework for talking about school climate and values, students, teachers, and administrators alike began to view their own and one another's behaviors according to very different standards. For the first time, students voiced a concern long felt and silently suffered by individual teachers—that students showed little respect for one another or for adults. They also asked teachers to gossip less about students and to plan more community-building activities. A greater sense of respect and community soon evolved, which, in turn, prompted students and teachers to take greater intellectual risks.

What Are Our Priorities?

The next step in the process of systemic change is to develop clear priorities and a timeline for change. School board members and community leaders must make clear their long-term commitment to a carefully thought-out strategy. Experience in corporations suggests that systemic change takes five or more years.

Like many CEOs, superintendents are under tremendous pressure to produce short-term results. Lacking a long-term contract and subject to the shifting sands of local politics, many well-meaning superintendents committed to systemic change feel they must undertake everything all at once in every school—an outcome-based diploma, interdisciplinary teams, a theme curriculum, heterogeneous grouping, advisory groups. As a result, even the best, most supportive teachers feel frustrated in their efforts, while the skeptics become even more resistant. All-at-once change efforts too often leave parents and students confused and demoralized, as well. Deep-seated resistance to change can, thus, quickly coalesce. Too little time and consideration are given to the new skills everyone—teachers, students, and parents—needs to become effective participants in the process.

Even with help, change comes slowly. The scarcest resource in the change process—even more than money—is time.

Different communities will evolve different priorities for change, depending on their most urgent needs. For many, moving toward an outcome-based curriculum, where students exhibit mastery through portfolios and exhibitions, centers everyone's attention on a concrete change. The results are often dramatic in terms of improved student motivation and performance. With proper training and support for teachers, teacher-student advisor groups and shared governance structures can quickly contribute to enhanced student-teacher relationships and a greater sense of community. On the other hand, the development of interdisciplinary curriculum units—a much more time- and labor-intensive process—will likely require substantial summer work and fundamental changes in a school's schedule—and so might better be deferred.

Whatever the initial priorities for systemic change, there should be no more than three to five objectives, and they should be broadly understood and supported through focused staff development. Further, priorities must be periodically assessed and modified, as necessary, by a representative school improvement committee. Every year, entire school communities—as well as individuals and teams within each school—should evaluate progress toward priorities set the previous year and agree upon the focus of the next year's efforts.

An essential part of any strategy for systemic change by corporations is research and development of new "best practices" both within and beyond the organization. For example, rather than try to change the entire company all at once, Compaq Computer created a small division to develop better manufacturing techniques—a "skunkworks" shop. Once this autonomous unit had perfected the new methods, staff members then taught them to others throughout the company. This same process, is the essence of the strategy Debbie Meier is using to replicate her successful Central Park East model in six other New York high schools.[3]

To develop and refine best practices for systemic change, we need a network of "skunkworks" schools of choice for educational R&D in school districts throughout the country. Let each district agree on a few clear priorities for these schools (or programs within schools), staff them with teachers interested in trying new ideas, open them to representative cross sections of families who choose to be in the program, agree on ways in which their work can be periodically assessed—and get out of the way! One of the most important ways in which state governments and the U.S. Department of Education might support systemic school change would be to provide the "venture capital" and technical assistance needed for the creation of such lab schools.

What Structures Do We Need?

Superintendents and school boards often implement systemic change by

imposing administrative, organizational, or structural reforms. Creating schools of choice, combining schools, eliminating department heads, restructuring the roles of central office staff, or implementing site-based management are some of the more common examples. Such efforts are, at best, premature. More often, teachers view them as capricious or illogical when the changes are not explicitly linked to new goals and strategies.

And they don't work. In her review of research on school-based management efforts, Jane David found few examples of site-based managed schools where school councils dealt with any issues "more difficult than creating a new discipline policy or decorating the entranceway."[4] And in a recent RAND Corporation study, *High Schools With Character (1990)*,[5] researchers concluded that in efforts to improve inner-city schools

> choice and the deregulation that accompanies site-based managed schools create the external conditions for effective schools. But the internal conditions—developing a coherent mission statement and the individual character that appeals to students and teachers—matter equally.

The study went on to document the need for "focus schools."

These studies confirm my own experience: only after goals, priorities, and sequential steps for change have been defined, can the conversation about new structures make sense. The need to decentralize management, elect committees for shared decision making, develop new methods of assessment, and create new ways for parents to get involved—all become more apparent and logical when they are explicitly designed to serve the change process. Agree on goals and values and define the tasks *first*. Then ask people how they want to work together, and what they need to get the job done.

Agree on goals and values and define the tasks *first*. Then ask people how they want to work together, and what they need to get the job done.

Which Skills? What Resources?

Community dialogue and agreement on the problem, a clear vision, core values, a few carefully chosen priorities rooted in a sequence of steps for change, and new or revamped decision-making structures—all will help define more clearly the need for the new skills and resources required to sustain the change process at every level.

With a clearer sense of system and school priorities, administrators and teams of teachers can more readily define what kinds of training and technical assistance they need. Parents may form their own support groups to better assist their children in school. And business leaders will find that they have new roles to play—helping the community to support change and serving on school improvement committees where people want to learn the skills of teamwork, agenda-setting, delegating, and so on. With greater involvement and clarity about the goals and methods of change, it also becomes easier to make the case to communities and businesses that new resources are needed to sustain systemic change.

Schools are beginning to recognize an additional need: the support of what Ted Sizer calls a "critical friend." A consultant who has both an understanding of the research and broad experience in schools attempting change can:

- lead the focus group sessions;
- help educate the community about economic and social changes;
- facilitate the development of goals, priorities, and strategies;
- teach new skills; and
- critique the ongoing work of committees, as well as individual teachers and administrators.

Corporations that routinely use long-term consultants to facilitate change have found that the expense is more than offset by improvements in both the speed and effectiveness of their change process.

Time: The Essential Resource

Even with help, change comes slowly. In my experience, the scarcest resource in the change process—even more than money—is time. Time for teachers to discuss students' needs, observe one another's classes, assess their work, design new curriculums, visit other schools, and attend workshops. Time for teachers and students to get to know one another. Time for parents and community members to become involved in children's learning. Time for leaders at all levels to reflect and plan collaboratively. Time—perhaps five years—to rethink the purposes of education, reinvent teaching and learning, and create new school cultures.

Can educators make the case in their communities for taking the time needed to do it right? Perhaps—but only by creating inclusive, thoughtful, compelling conversations about purposes and other critical questions. And then by acting with urgency, discipline, and courage. ■

[1]See Claremont Graduate School, (1992), "Voices from the Inside: A Report on Schooling from Inside the Classroom," (Claremont, Calif.: Claremont Graduate School).

[2]I outline a proposed framework in greater detail in "Improving High Schools: The Case for New Goals and Strategies," (May 1993), *Phi Delta Kappan*.

[3]See *The New York Times*, July 14, 1993, A1.

[4]See J. L. David, (May 1989), "Synthesis of Research on School-Based Management," *Educational Leadership* 46: 45-53.

[5]P. Hill, G. Foster, and T. Gendler, (1990), *High Schools With Character*, (Santa Monica, Calif.: RAND Corporation).

Author's note: Wagner's book, *How Schools Change: Lessons from Three Communities*, will be published next spring by Beacon Press.

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Moving from Seat Time to Mastery: One District's System

Kevin Castner, Lorraine Costella, and Steve Hess

The journey to become an outcome-based system is fraught with many lessons. Schools in Frederick County, Maryland, share a map of their process.

Six years ago, Frederick County, Maryland, began a major restructuring effort, involving 30,000 students and 46 schools and covering all disciplines and grades. When we decided to become an outcomes-based school system, we could only guess at the impact our undertaking would have upon student learning—to say nothing about our curriculum or our philosophies on teaching and assessment!

The first generation (1988-92) of restructuring involved five components—some were planned and some forced themselves upon us: developing student outcomes, defining curriculum, developing new assessment tasks, planning for instruction, and providing for staff development throughout the process. The good news about restructuring is you can start tomorrow. The bad news is you are never finished.

Photos Courtesy of Frederick County, Maryland, Public Schools

Our First Steps

The heart of what we call the "System for Effective Instruction" is a three-part essential curriculum pyramid model that creates objectives for each course, goals for each discipline, and—most important—five integrated learner behaviors that serve as developmental and exit outcomes (see fig. 1).

First, we had to define what Frederick County students should be able to do in each curricular area and how well they should be able to do it. The goal was to align our written, taught, and tested curriculum. At the top of our list was an emphasis on deep understanding and higher-level thinking skills.

Our five essential learner behaviors describe what each student will be able to do upon graduation in order to pursue lifelong learning and develop career and economic competence through:

- effective communication,
- problem solving and critical thinking,
- social cooperation and self-discipline,
- responsible citizenship in community and environment, and
- a lifestyle that values wellness and aesthetics.

Demonstration of Learning

Next, we had to determine what we would accept as evidence of students' learning. To that end, two of our eight high schools participated in pilot projects to develop student portfolios and senior projects to indicate whether students were, indeed, achieving the essential curriculum.

For example, a senior project to show effective communication might be an oral presentation, a written communication, or a visual display. A student could demonstrate problem-solving and critical thinking skills by defending solutions to real-life prob-

lems and situations. The ability to assess self, others, and ideas demonstrates critical thinking skills.

In the pilot, each student, assisted by a teacher, was encouraged to develop original projects if he or she wished. A project with a career and technology focus might be the following:

> You are a carpenter assigned the responsibility for working with a customer to determine the best design, as well as estimated costs, for building a garage on a property with an existing residence. You must:
>
> - interview the customer to determine storage needs, cost allowances, and preferred exterior finishes;
> - develop a proposal including recommended design, exterior finish, and a basic sketch;
> - write a cover letter to your customer summarizing your proposal and explaining why your firm should be hired to do the work.

In each curricular area, essential learner behaviors are supported by essential discipline goals, which, in turn, are supported by essential course objectives. For instance, a task that requires 7th graders to plan a field trip to a museum in Washington, D.C., could meet two essential course objectives: (1) collect, organize, represent, and interpret data and (2) make estimates appropriate to given situations.

These 7th grade objectives support our K-12 mathematics discipline goal: to develop mathematical skills and reasoning abilities needed for problem solving. In addition, the lesson helps students gain skills in effective communication, social cooperation, and citizenship.

Each level and grade of schooling, beginning in kindergarten, uses the foundation of individual courses and disciplines to build toward mastery of the learner behaviors at the top of the pyramid. Integrated essential learner behaviors are important for success in life. No one in the real world stops and says, "Now I am going to do Algebra I, AP Chemistry, or World History." They just switch gears to accomplish a task.

New and Improved Assessments

What about testing? The ability to fill in the correct answer bubble is not enough for our new curriculum. True mastery requires the ability to apply what has been learned to real-world situations.

For example, an essential course objective in 5th grade language arts is for a student to read or listen to an expository selection in order to process information at the literal, interpretive, and critical levels. Our emphasis was on thoughtful mastery of important tasks, rather than thoughtless knowledge of isolated facts and skills.

Traditionally, because of ease of measurement, our assessment tasks had tended to limit instructional focus to lower-level skills and knowledge. The clear intent of the Frederick County essential curriculum was to reverse this tradition. We determined what was important for students to know and be able to do, and then we decided how to measure it. This system requires the performance of exemplary tasks that reflect the actual performances expected of students.

If we want students to "think with words and think with numbers," we must emphasize the evaluation of student ability to understand and problem solve. The isolated reading passages and simple word problems found on standardized tests did not meet this need. Routine assessment of prerequisite skills has a place in our criterion-referenced evaluation system, but the relative balance is weighted in favor of critical thinking, problem solving, and communication.

As we began developing activities, we emphasized formative assessment to give teachers a way to monitor student progress on the essential curriculum. We view formative assessments not as teaching to the test, but testing what we teach.

Although initial training, feedback, and review were provided by experts like Grant Wiggins, Frederick County teachers actively developed the assessment tasks. In February 1988, when we invited teachers to apply for summer curriculum/assessment writing workshops, their response was outstanding. As one teacher said, "I don't want someone else telling me what I'll be teaching for the next 10 years." In designating teachers for the workshops, curriculum specialists sought a balanced representation: experienced and new teachers, males and females, cultural diversity, and a range of instructional levels.

In the spring, acceptance letters went out, emphasizing the importance of the workshops and the work done in them to our school system. Planning for the summer workshops included extensive research and visits and phone calls to school systems already involved in performance-based assessment. Before we began work, we took advantage of several opportunities to plan and confer with consultants.

The Summer Workshops

Two weeks of workshops began with much fanfare that summer. More than

200 teachers from grades K-12 attended. The superintendent and the president of the board of education were there to set the tone and talk about the importance of assessments in our restructured school system. Participants with young children found child care available on the premises. A media specialist provided research materials, and on-site typists at a word processing center turned out finished products.

During the first day or two, several large-group meetings set the framework. Grant Wiggins launched the workshop series by providing an overview of authentic assessment. Then teachers and curriculum specialists worked to translate this broad perspective into real assessments for Frederick County.

We learned a great deal in our earliest workshop. As teachers created assessment tasks, their efforts touched other curriculum areas and grade levels. What developed was something unexpected and exciting—a common educational focus! However rosy a picture we paint, we admit that writing these first assessment tasks was a struggle. Teachers worked diligently to write the assessments, only to find that they were uninteresting to students, or that they did not test what we wanted them to test.

Finally, at the end of the first two-week workshop, the assessments began to jell. And when the workshops ended, each curricular area had several assessments to pilot.

As teachers were writing assessment tasks, they were also developing scoring systems for student performance at various levels. After debating the merits of different frameworks, we finally decided to use four-point rubrics for continuity across schools, grades, and disciplines. While specific rubrics are written for narrative writing, problem solving, and reading comprehension, for example, all use the same framework:

4 = exemplary (*fully* meets criteria)

3 = proficient (*adequately* meets criteria)

————Mastery Line————

2 = approaching proficiency (*some times* meets criteria)

1 = evidence of attempt (*seldom* meets criteria)

The four points are not equivalent to letter grades. They are a method of assessing the degree of proficiency exhibited in a student's response to an assessment task. The goal is to have all students progress to the point of mastery, with the teacher functioning in the role of a coach.

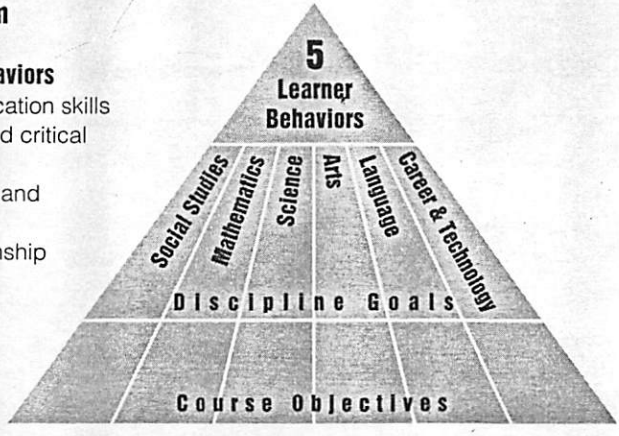
Our goal for the initial year was to pilot assessments in language arts and math in grades K-8. Eventually we hope to develop essential curriculum and assessment tasks in every area. To date, we have accomplished this in language arts, math, science, social studies, art, music, physical education, and business education.

Figure 1

Essential Curriculum

Essential Learner Behaviors

1. Effective communication skills
2. Problem solving and critical thinking
3. Social cooperation and self-discipline
4. Responsible citizenship in community and environment
5. A lifestyle valuing wellness and aesthetics



Selection of "Anchor Papers"

Once the teachers had completed their work on assessments during the workshops, our curriculum specialists spent the remainder of the summer finalizing the tasks and planning teacher training. During a day of inservice before schools opened, the curriculum specialists met with teachers in their curricular areas and presented overviews of performance-based assessments, discussed the importance of formative assessments, and illustrated tasks that had been written during the summer.

Teachers in the pilot schools worked closely with the curriculum specialists to collect examples of student work. These examples, called *anchor papers*, provided consistency in evaluating student work and gave us samples of mastery, as well as every other point on the rubric.

The selection of anchor papers took place at a number of painful meetings during the first four months of school. Selection was the result of serious debate, which made us look at what the standards for mastery were. For example, teachers asked, "Is this what we want the writings of a 3rd grader to look like?" or "What needs to be in a response that shows mastery?" It was very difficult to look only at responses and not focus on the effort of the student.

By looking at the anchor papers, we found that teachers could learn how to adjust instruction. After piloting the assessments and agreeing on the anchors that best illustrated the standards, we faced the task of inservicing all the other teachers! The only way we could accomplish this awesome task was to use a "trainer of trainers" model. In elementary schools, the language arts curriculum specialist met with the reading specialists and developed a training module on assessment. Each reading specialist took the module and used it as the basis for staff development in his or her school.

Variations on this procedure were used in every curricular area. Sometimes curriculum specialists worked

Continued on p.50

Continued from p.47

with department chairs, team leaders, or assistant principals. These people, in turn, worked with the teachers. Of course, curriculum specialists, our testing supervisor, and staff development facilitators were available for assistance.

Frederick County has used the following model of curriculum and assessment development for the last five years:

1. write the curriculum and assessment;
2. pilot the curriculum and assessment in selected schools;
3. refine and adjust the curriculum and assessment;
4. provide inservice for all teachers; and
5. adjust, refine, and rewrite.

The curriculum can be changed and the assessments can be changed, but to make an impact on instruction and achieve higher-level student behaviors, the change must take place in instruction.

Improvement as a System

Next we began to develop summative evaluations, using the same procedures used to write essential curriculum and formative assessments. The formats of formative assessments and rubrics are similar to those used in the summative evaluations. However, the summative evaluation gives the school and the school system information about how groups of students, rather than individual students, are achieving. This information helps us adjust as a system. If students do poorly in 3rd grade mathematics across the school system, we know we need to analyze our curriculum, instruction, and/or assessment procedures. Formative assessment helps us adjust for a student; summative assessment helps us adjust as a system.

In our school system, yearly progress reports are published so that our public can view the results of these assessments. Our community is informed each August of the percent of students who have mastered the essential curriculum, with the results disaggregated by gender, ethnicity, and socioeconomic status.

Teachers in different classrooms and schools must agree on the performance standards for students. Samples of student responses to the summative assessments are selected from a variety of schools so that teachers can "anchor" their evaluations of student work. The published set of anchor performances is available to all teachers in all schools, and yearly "checks" of scoring consistency help us to adjust staff development programs.

What We've Learned

After six years of hard work, we realize the key role staff development plays in the restructuring process. Teachers need to learn how to assess students' knowledge and also how to teach the higher-level behaviors required by the performance tasks. Performance-based assessment requires students to perform at a higher level than do multiple-choice assessments. The change from multiple-choice testing to teaching that emphasizes problem solving and higher-order thinking cannot be assumed. It must be planned.

Another lesson is that the development and scoring of assessments is labor-intensive. Time is needed to write assessment tasks and to train teachers how to give and score them. We have found it very profitable to combine resources with other districts in order to develop assessments and share training of staff. During the summer of 1991, 16 Maryland school districts worked together to develop assessments, rubrics, and anchors for language arts, mathematics, science, and social studies in grades K-8. The result was three volumes of assessments, which would have taken each of us years to develop! The assessments are now part of a computerized database, which is accessible to the staff upon request. The Maryland Assessment Consortium, an ongoing entity, represents all 24 Maryland school districts.

While much attention has been given to the written curriculum and assessments, if assessment is to increase learning, it must be directly integrated into daily teaching. Only when teachers learn to analyze the assessments will they be able to coach students in the higher-level behaviors.

What Lies Ahead

The second generation (1992-97) of our restructuring process is already under way. A videotape and accompanying brochure have been provided to all schools to assist parents and the community in understanding "Teaching and Testing for the 21st Century."

The original design of the System for Effective Instruction emphasized building the foundation of the essential curriculum pyramid. The second generation will focus more directly on the original reason for moving from seat time to mastery: ensuring that all students reach high standards of understanding and application. Developmental and exit portfolios will eventually provide the evidence of integrated mastery required for success as productive adults and lifelong learners. ■

Kevin Castner is Associate Superintendent of Curriculum and Instruction, **Lorraine Costella** is Assistant State Superintendent for Instruction, and **Steve Hess** is Director, Criterion Referenced Evaluation and Testing, Frederick County Public Schools, 115 E. Church St., Frederick, MD 21701.

Not Just for Future Scientists

John E. Penick and William H. Leonard

Recent national recommendations have suggested that science curriculums need to reduce trivial content and lecture, emphasize thinking skills, and contextually integrate content from other subjects (Rutherford and Ahlgren 1990, National Research Council 1992). These trends reflect a concern that science curriculums should be relevant to students and foster positive attitudes toward science. As a result, science curriculums have begun to recognize the value of reducing barriers between the community and its classrooms (Yager 1993).

Until recently, such curriculums were somewhat informal, developed by local groups for their own use. Now more formal efforts are taking shape. A significant beginning was *Chemistry in the Community (ChemCom),* developed by the American Chemical Society (1992).

ChemCom is designed for college-bound students who are not necessarily contemplating science careers. Rather than beginning with a review of mathematics or atoms, the text opens with a story of a fish kill in a small river. As students try to determine its cause, they learn chemistry in context. And, they learn it well. A recent evaluation of *ChemCom* (Sutman and Bruce In press) reveals that *ChemCom* students, when compared to regular high school chemistry students, are more excited about chemistry's usefulness and actually scored higher on an American Chemical Society final exam. This is particularly exciting when you consider that the *ChemCom* text covers only a fraction of the content in many textbooks.

The success of *ChemCom* led the National Science Foundation (which partially funded *ChemCom)* to fund *BioCom,* a curriculum with many of the same goals. Using *BioCom,* students will apply biology concepts in familiar settings such as a grocery store, a gas station, and a trash dump. They will spend most of their time in investigations, applying knowledge and communicating results. Like *ChemCom, BioCom* will cover fewer traditional topics. The curriculum will have a strong environmental thrust and will be guided by research in learning theory and curriculum design. *BioCom* will be field-tested in 1994-95 for delivery in 1996.

Also funded by the National Science Foundation, *Active Physics* is a similar project being developed by The American Association of Physics Teachers and The American Institute of Physics. Through health care, transportation, sports, and other topics, students will be introduced to key physics principles, concepts, and measurements. As in the other curriculums, ideas are developed in a concrete context. *Active Physics* should be available in the fall of 1995.

The latest in the series of COMS is *PsyCom,* from The American Psychological Association. Although funding has not yet been obtained, the Association's past-president, Charles Spielberger, envisions that *PsyCom* will be a high school psychology curriculum that focuses on scientific aspects of psychology as well as on interpersonal relations, attitudes, anxieties, and other topics of interest to high school students. The American Psychological Association has included the developers of *ChemCom, BioCom,* and *Active Physics* on its National Advisory Panel, making the development of *PsyCom* an interdisciplinary effort.

Because we all need scientific concepts and applications in order to function effectively in our complex society, science should not be taught just for future scientists. The COM curriculums could help meet this need. A school with all four of the COMS (and perhaps a badly needed *EarthCom*) would offer a formidable curriculum emphasizing active investigation and learning, applied knowledge, cooperative learning, and a more facilitative role for teachers. ■

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American Chemical Society. (1992). *Chemistry in the Community.* 2nd ed. Dubuque, Iowa: Kendall/Hunt.

National Research Council. (1992). *Fulfilling the Promise.* Washington, D.C.: National Academy Press.

Rutherford, F. J., and A. Ahlgren. (1990). *Science for All Americans.* New York: Oxford University Press.

Sutman, F., and M. Bruce. (In press). "Chemistry in the Community." *Science Education International.*

Yager, R. E., ed. (1993). *What Research Says to the Science Teacher: Vol. 7.* Washington, D.C.: National Science Teachers Association.

Authors' note: For information on *ChemCom,* write Sylvia Ware, American Chemical Society, 1155 16th St., N.W., Washington, DC 20036; on *Active Physics,* Arthur Eisenkraft, 60 Stormytown Rd., Ossining, NY 10562; on *PsyCom,* Charles Spielberger, The American Psychological Association, 750 First St., N.E., Washington, DC 20002; and for information on *BioCom,* write to the authors.

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11/17

Name 3 ways you use energy seem necessary to carry out your life.

LIGHTS
FOOD
MICROWAVE OVEN

What 2 things do you use in your home that use the most energy?

TV
MICROWAVE OVEN

1 way you could conserve energy.

TURN THE TV OFF

3 appliances you own that you don't really need.

IRON
HAIRDRYER
OVEN

Earth Day 1990

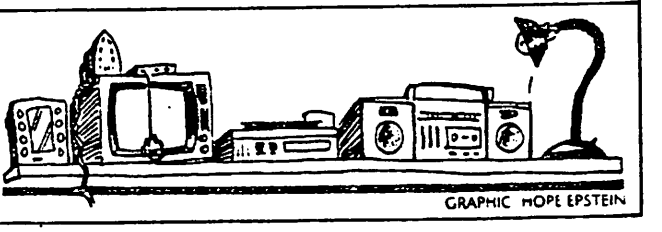
11/17

ENERGY HOME SURVEY—GRADES 4-6

HOME APPLIANCES

Name: _____ My estimate of the number of appliances in my home: _____

List all the appliances you have at home. Be sure to record the number of each kind that you find.

Example: ELECTRIC CLOCKS IIII	
	 GRAPHIC HOPE EPSTEIN

Earth Day 1990

ENERGY HOME SURVEY—GRADES K-3

Name: _____

Choose an hour block of time during which you and your child will record all the ways that you use energy Go about your normal activity but keep this survey sheet with you. Record every time you turn on a light, use an appliance, talk on the phone, etc. check those that were used during a one hour block of time.

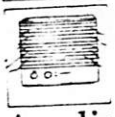
The following list identifies some typical ways energy is used in the home. Use it as a starting point to keep track of your energy use. Add to the bottom of the list other ways you use energy. Put a check, or have your child check the appropriate time you completed this survey:

❑ morning ❑ afternoon ❑ night

Typical home energy uses:


lights _____


hot water _____


home heating _____

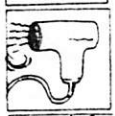
Appliances


television _____


radio _____


record player, stereo _____


telephone _____


hair dryer _____


stove and/or oven _____


microwave _____


refrigerator _____


washer _____


dryer _____


toaster _____


blender, or food processor _____


garbage disposal _____


dishwasher _____


clock _____

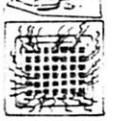

can opener _____


electric blanket _____


iron _____


typewriter, computer _____


vacuum cleaner _____


air conditioner _____

Other: Draw pictures on back.

MARCY COOK
Math Specialist - Consultant for Elementary Schools
P.O. Box 5840 • Balboa Island, Ca. 92662-5840
(714) 673-5912
FAX (714) 673-7909

COLOR IT ON THE HUNDRED CHART

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

WHAT DOES IT LOOK LIKE?

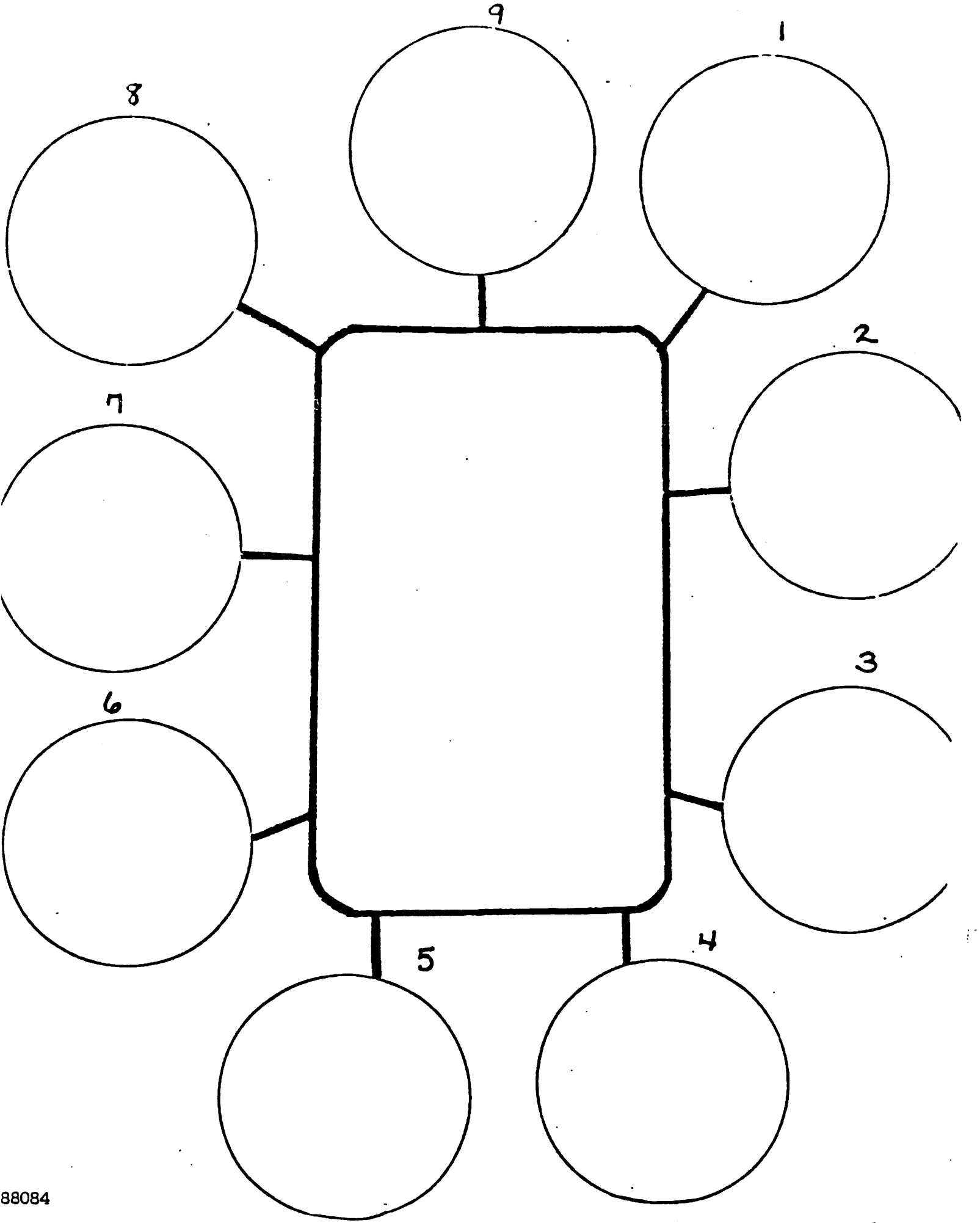
a number? _____

a letter of the alphabet?

_____

a word? _____

an object? _____



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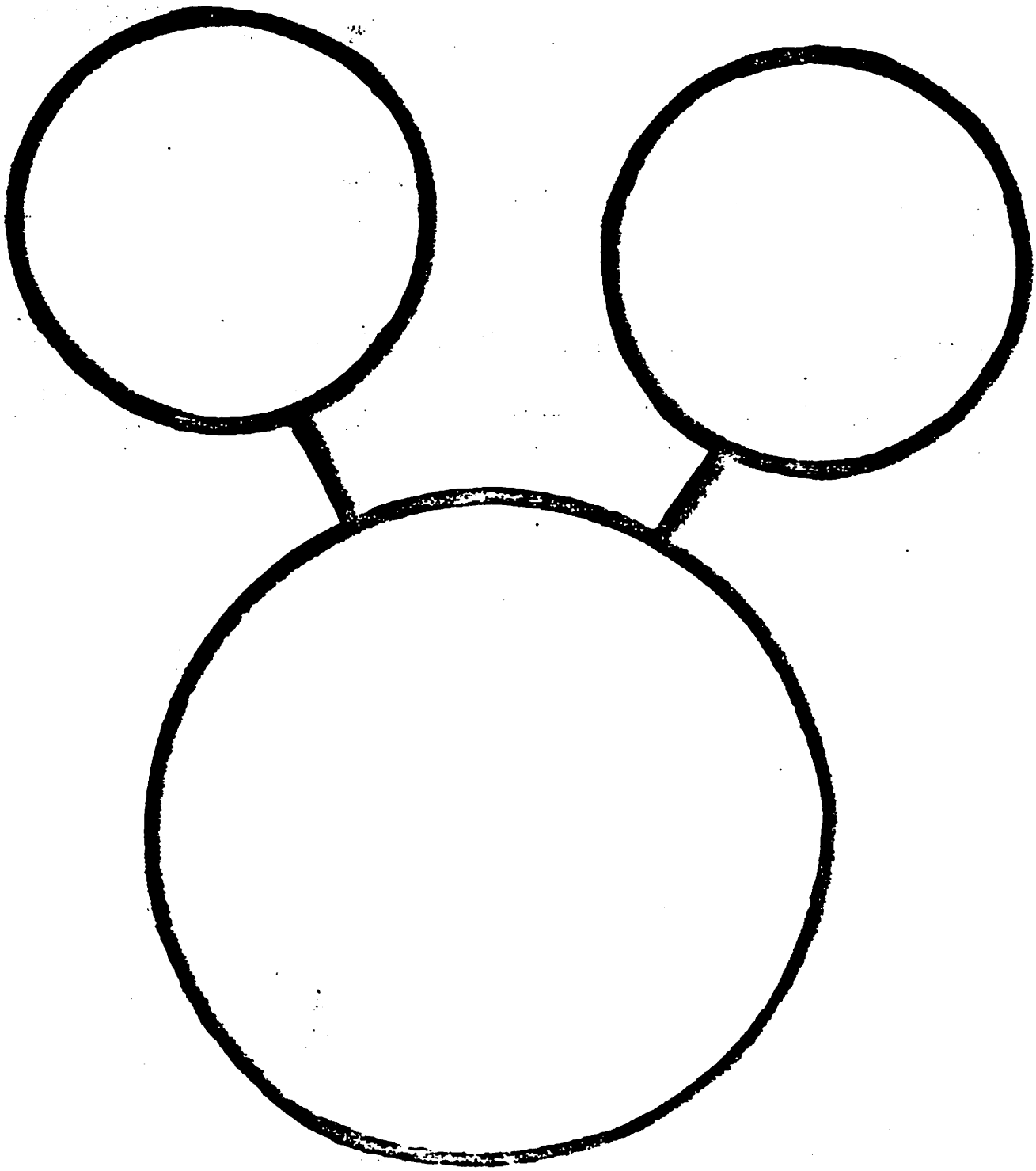


But Who's Multiplying?

PRODUCT BOARD

1	2	3	4	5	6
7	8	9	10	12	14
15	16	18	20	21	24
25	27	28	30	32	35
36	40	42	45	48	49
54	56	63	64	72	81

1	2	3	4	5	6	7	8	9

FACTOR BOARD

- 10/27
- Dennise lesson plan

Curds and Whey

Primary Objective

Students will be able to separate milk into its solid and liquid parts. Vinegar causes the small undissolved particles to clump together, forming a solid called curd. The liquid portion is referred to as whey.

Concepts

1. A colloid is a mixture of liquids and very tiny particles that are spread throughout the liquid.
2. Milk is a an example of a colloid.
3. To separate milk into its solid and liquid parts.

Materials

- Milk
- Vinegar
- Small Baby food Jar
- Tablespoon
- stirrers

Procedure

1. Give each child a clear cup with fresh milk (About 1/4 cup)
2. Add 2 tablespoons of vinegar and stir.
3. Allow the jar to sit for two to three minutes.
4. Record observations.

10/27
Tennis part 2

Water Polo

Primary Objective

Students will be able to explain that beads of water are caused by water's invisible elastic skin - surface tension.

Concepts

1. Water has special properties which give it surface tension.
2. Water is attracted to water; this is called cohesion.
3. Water is attracted to other surfaces; this is called adhesion.
4. Water surface tension can be broken with dish soap or detergent.

Materials

- Half-straws or medicine droppers
- Wax paper squares (about 7" squares)
- Styrofoam cups, half full of water
- Toothpicks
- Paper towels
- Vial of detergent

Procedure

1. Give each student a toothpick, paper towel, sheet of wax paper, ½ cup of water, and a half-straw or eye dropper.

2. Put the wax paper square on top of the paper towel.

3. Use a straw or an eye dropper to pick up water and drop beads on the wax paper. Use the blunt end of the toothpick to move the water beads around, connecting and disconnecting water droplets.

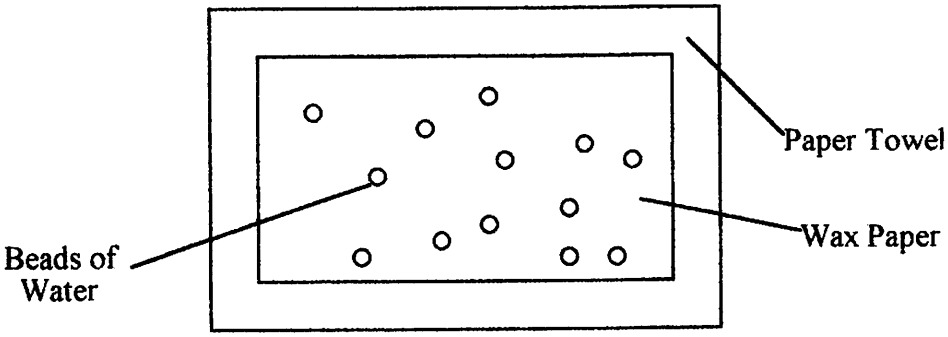
4. Point out to students that the beads of water are attracted to each other. After a few minutes of playing "water polo", announce that you will now dip your toothpick into the "mystery" solution (detergent).

5. If you are having everyone do the activity, tell students to hold their toothpicks in the air until the whole class has dipped into the mystery solution. Then have them play "water polo" again by using the toothpick to lead the droplets around.

6. The mystery solution will break the water surface tension and the water may leak through the wax paper.

7. You can have the students use the paper towels to clean the top of their desks.

8. Ask students how they think detergent cleans things.



SCIENTIFIC EXPERIMENT

PROBLEM: What will detergent do to food coloring that is floating on milk?

MATERIALS:

1. BOWLS
2. MILK
3. FOOD COLORING
4. LIQUID DETERGENT

HYPOTHESIS: The food coloring will _____

because _____.

PROCEDURE:

1. Pour about 1" of milk into the bowl.
2. Wait until the milk is still. Gently drop some dots of food coloring into the milk.
3. Quietly pour a stream of detergent down the side of the bowl.
4. Watch what happens!

CONCLUSION: The food coloring _____

_____.

DRAW A PICTURE OF YOUR EXPERIMENT:

Beth Hillger, Registration
1891 Garland Lane
Anaheim, CA 92807

BULK RATE
US Postage Paid
Santa Ana, CA
Permit No. 1152

Orange County Mathematics Council

SEVENTH ANNUAL FALL CONFERENCE

Irvine High School
October 2, 1993 8:00 a.m.-3:30 p.m.

A New Era in Assessment

8:30-9:25 a.m. Keynote Speaker (Secondary)
Larry Chrystal, Director, California Mathematics Project, UCI
Assessment, the Final Frontier

9:40-10:35 a.m. Keynote Speaker (Elementary)
Tony Spears, San Diego County Office of Education, CMC Past President
Connecting Assessment to Curriculum and Instruction

SECTION SPEAKERS

Session I (Elementary): 8:30 - 9:25 a.m.

K-3 *Let's Go Fishing!* Dorothy Valencia, SAUSD
K-3 *Eat Your Way Through Math, Peanuts to Rice.* Marylou Miller, Fullerton Elementary SD
K-4 *Math Assessment Portfolios.* Sheila Rogers, Newport-Mesa USD
K-5 *Exploring Quilt Patterns.* Lillian French, SAUSD
2-4 *Tube-ular Math Games.* Socorro DeSantos, SAUSD
3-5 *Discretely Speaking...* Sarah Carmon, SAUSD
3-5 *Know Your Place!* Pam Manke & Trish DeMilt, SAUSD
3-6 *Origami Math.* Tina Lee, Westminster USD
3-6 *Let the Buyer Beware.* Sally Melton, Dennis McGeeney & Rob McDonald, SAUSD
4-6 *Math Field Day.* Cheryl Bean, Garden Grove USD

Session I (Secondary): 10:00 - 10:55 a.m.

5-7 *Family Math in Junior High.* Sherry Skipper, SAUSD
6-8 *The Math-Art Connection.* Elisabeth Jevor & Sheila Berman, Los Angeles USD
6-8 *Rising Stocks.* Tina Harvey, SAUSD
6-9 *Take the Abstract out of Algebra.* Sybilla London, Inglewood USD
7-12 *Constructions Without a Compass.* Beth Hillger, Fullerton Union HSD
9-10 *Overview of Change From Within.* Janice Shultz, IUSD
9-12 *Estimating Fish Population: Ratio & Proportion.* Barbara Post, Garden Grove USD
9-12 *"Math A" to Z.* Sandra Porter, SAUSD

Program continues--->

OCMC Fall Conference, Irvine High School, Oct. 2, 1993 (cont'd)

Session II: 11:05 a.m. - 12:00 p.m.

K-2 *Used Numbers, K-2.* Shirley Roberts, Los Angeles USD
K-3 *Frog and Toad in Math.* Deirdre Parkinen & Jeanine McCalla, SAUSD
K-5 *Interactive Homework - Involving Parents in Math.* Andrea Earl, SAUSD
2-6 *Math in Motion.* Barbara Pearl, Math Consultant/Author
4-6 *My Travels With Gulliver.* Anita Ford, SAUSD
4-6 *Math in the Mind's Eye.* Marelle Dorsey, GGUSD
5-9 *Induction: The Road to Knowing Mathematics.* Judith Jacobs, Cal Poly Pomona
6-8 *Math Renaissance.* Valerie Henry, Irvine USD
6-8 *The Math-Art Connection (continued).*
6-12 *Questioning: Changing What We Ask.* Ana M. Golan, Mathematics Renaissance
7-12 *Mathematical Power Through Investigations.* Jerry D. White, Huntington Beach Union SD
9-12 *Discovering Geometry.* Bill George, Irvine USD

Complimentary lunch in exhibitors area: 12:00-1:00 p.m.
Vendor exhibits are open from 8:00 a.m. to 2:00 p.m.

Session III: 1:00 - 1:55 p.m.

K-2 *Multi-day Investigations.* Cristina Garcia, SAUSD
K-6 *Change: A Process, Not an Event.* Cindy Stephens, Addison-Wesley
2-4 *Great Graphs: More than Pretty Pictures.* Lynda Holman, Educational Consultant
3-5 *CAPtivities (4th Grade Cap Activities).* Samie Colunga & Patty Murphey, SAUSD
3-5 *Bring Writing into Your Math Classroom.* Juanita Walker, SAUSD
3-6 *Fun With Cooperative Learning and Mathematics.* Beth Andrini, SAUSD
6-8 *Putting it All Together with the NCTM Addendum Series.* Connie Hughes, Irvine USD
6-8 *Writing Open-Ended Questions.* Joyce Ireland, SAUSD
6-8 *Line Designs.* Sharon Trax, SAUSD
8-12 *Enhancing the Math Curriculum with Graphing Calculators.* Richard Glick, Capistrano USD
9-12 *Mathematics A & B: Research Test for the Framework?* John D. Leonard, Los Alamitos USD

Session IV: 2:05 - 3:00 p.m.

K-3 *Dinosaur Discovery.* Kathleen J. Stanton, SAUSD
K-12 *Teacher as Facilitator.* Larry Chrystal, UCI
2-4 *Strategies for Teaching Place Value.* Cory Gonzales, SAUSD
3-6 *Making the Math Connection.* Nancy Cangiano, Cindi Hausheer, Saddleback USD
3-6 *Math Starters and Stumpers.* Peggy Quinn, SAUSD
6-8 *Writin' 'n 'rithmetic.* Marion VanVoorhis & Alberta Strey, Fullerton Union HSD
6-8 *Pattern Blocks, Problem Solving, and Projects.* Delia Benn, SAUSD
7-12 *Student Creativity Unleashed.* Roger Enge, Saddleback Valley USD
8-12 *Graphs That Talk.* Don Houser, Fullerton Union HSD
8-12 *Changes in the Algebra I and Geometry Curricula.* Dianne Camacho, Downey USD
11+ *Trigger Your Imagination with Trigonometry.* Harris Schultz, California State University, Fullerton

Closing Remarks and Drawing for Door Prizes: 3:05-3:30 p.m.

Don't miss this extraordinary opportunity for professional development.

Act now! Pre-registration deadline is September 25.
The full program brochure will be sent to all preregistrants.

Onsite registration and refreshments begin at 8:00 a.m.

ENHANCED MULTIPLE-CHOICE QUESTION
INTERMEDIATE GRADES

Functions Mathematics Strand

What's the next number in the pattern?

3 6 9 12 15 18

12, 15, 21, 30, 42, 57

Circle the number that continues the pattern.

A. 60 **B. 69** **C. 75**

D. 96 **E. 114**

Explain how you found your answer. Extend this pattern-

MULTIPLES OF (3) ADDED TO EACH PRECEDING NUMBER

Interactive Homework:

Involving Parents in Math through Cooperative Homework Activities

Presented by:
Andrea Earl
Franklin Elementary School
Santa Ana Unified School District

OCMC Math Conference
October 2, 1993

Dice Games

corresponding sides = 7
eg. 1 6

Labeling Dice:

-dots, numbers, 1- ?
-by 10's or 100's

Number Recognition:

- each player roles a die and reads the number, highest/lowest number wins

Place Value

-roll 2 or 3 dice, place dice in order to create the largest/smallest number to win

-reroll a single die 2-4 times, write each digit as you roll it to create a 2-4 digit number, read the number, largest/smallest wins

greater than
less than

8 6 2 ○ 5 2 0

Basic Operations:

-add sum of 2 dice, largest/smallest wins
-add the number of each roll to the total from previous rolls, 1st person to reach 50, or 100 wins
-subtract from 100, person closest to 0 wins
-multiply 2 dice, highest lowest wins
-multiply 2 dice and add to 100
-combine activities from both sections above

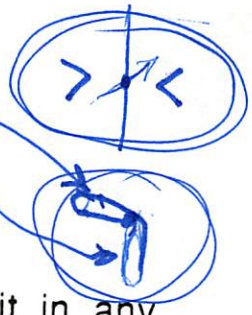
Deciding who wins GREATER THAN LESS THAN

Digit Squares

SPINNER

pencil

paperclip



Directions:

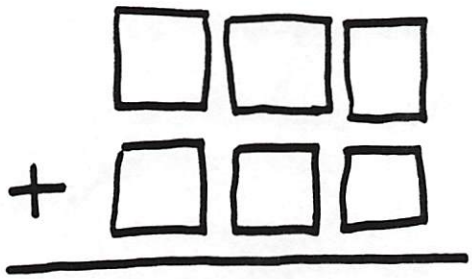
Use card with digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

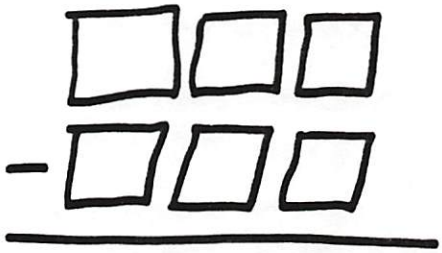
Pull one card at a time, each player writes the digit in any open square.

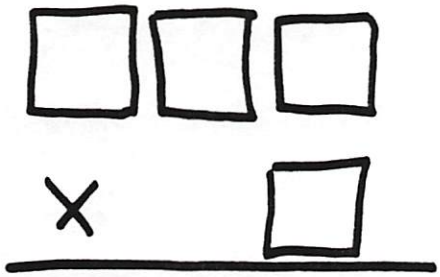
After all squares are filled, players preform the appropriate operation.

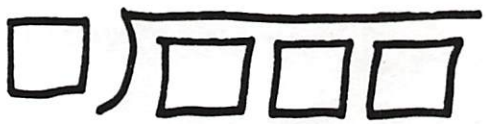
Option: Tally or add results for 10 rounds.

Highest or lowest answer/total wins.









Other Activities

Graphing:

-students interview 10 people at home (including 1 parent) and record results

-topics can be teacher or student generated (see attached)

Fractions:

-interview family members and record the fraction pertaining to each response (see attached)

Geometry:

-write down the names of objects around the house which are cubes, rectangular solids, pyramids etc...

-measure the perimeter and/or area of common household objects

Probability & Statistics:

-play probability games with a parent, record results

-games can use dice, spinners, paper bags, pennies etc...

Sets & Logic:

-interview family members and fill in a venn diagram

Name _____

Family Fractions

1-2nd grade: How many - just number

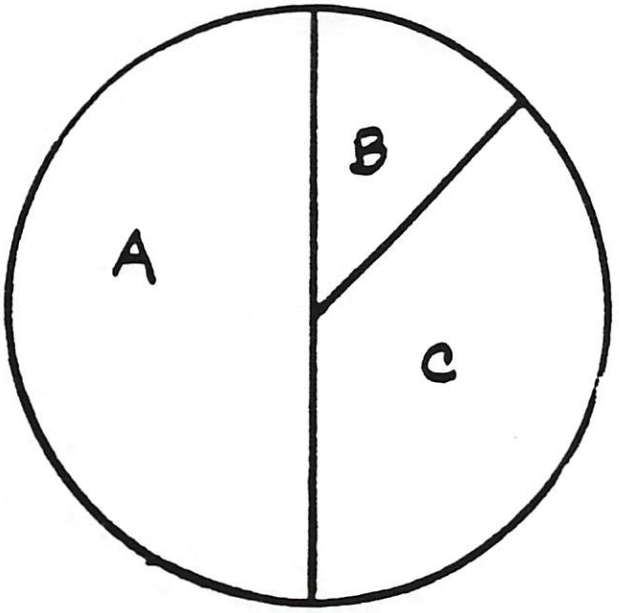
1. How many people live in your house? _____
2. What fraction are girls? _____
3. What fraction are boys? _____
4. What fraction go to school? _____
5. What fraction are 5 years old or under? _____
6. What fraction are 35 years old or older? _____
7. What fraction work outside the house? _____
8. What fraction go to _____ School? _____
9. What fraction like chocolate ice cream? _____
10. What fraction like pizza? _____

Draw a picture of the people who live in your house.

---

can use Venn Diagram

Spinners



I. Predictions

A = _____

B = _____

C = _____

Total number of spins = 20

II.

Tallies	Total
A =	
B =	
C =	

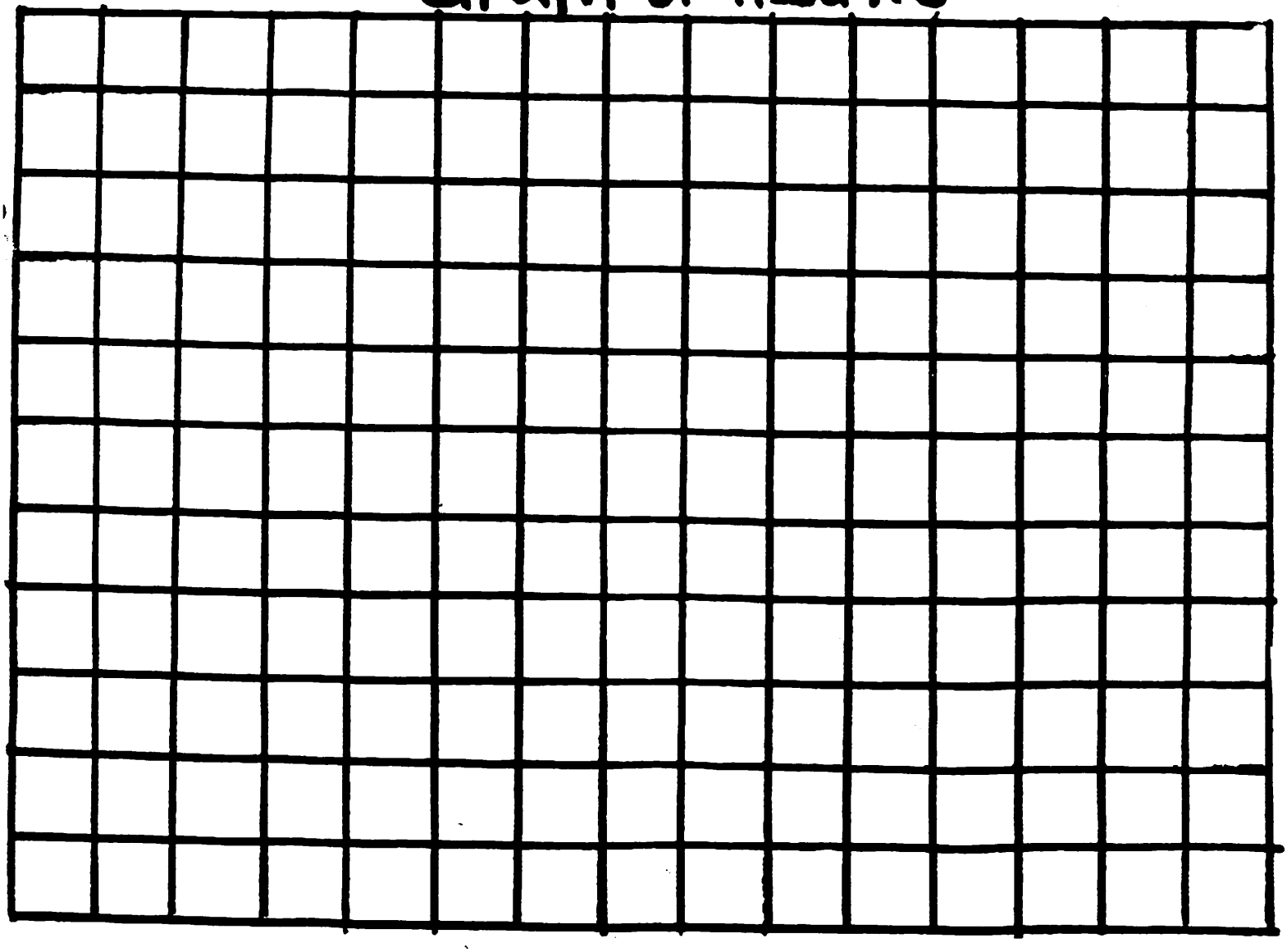
Favorite Animal

scrapbooking – Pinterest/TV shows friends/family agree				
			Fish	Bird

Dice Toss

	Estimate	Tally	Actual
1			
2			
3			
4			
5			
6			

Graph of Results



CHRISTIE YOSHIDA LAWSON ELEMENTARY 11/11

Student Worksheet

Name _____ Date _____

INTRODUCTION

Owl pellets are the undigested remains of prey ingested by an owl. The owl swallows its prey whole, and during the process of digestion, the soft parts of the prey are dissolved and passed on to the intestine for absorption. The hard, non-digestible parts – bones, teeth, fur, feathers, and chitonous remains of insects are compressed in the gizzard and passed on to the *proventriculus* where the pellet remains until it is expelled. These pellets are not eliminated as feces, but are regurgitated through the mouth.

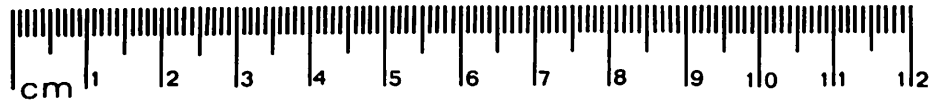
Pellets are not found exclusively within the owl families. There are many species of birds known to regurgitate pellets; hawks, eagles, kites, harriers, falcons, and even robins are some of the more familiar ones. Out of all types of pellet ejectors, the efficiency of the process is probably as high in owls as in any other bird.

The Common Barn Owl feeds in early morning and early evening and will usually produce one to two pellets per day. Glossy black when fresh, the pellet remains smooth and dark in color when dry. These pellets can provide valuable information pertaining to the diet of owls. By studying the contents of owl pellets, one may discover seasonal, regional, and habitat differences and even differences in individual tastes between owls. Also, pellets can be used to effectively illustrate the nature of food chains, to demonstrate the role of avian predators within the ecosystem, and to provide information about the presence and relative abundance of animals in a particular area. As an educational tool, pellets can also be used to introduce students to skeletal anatomy and to teach others how to identify an animal by its skull and jaw bones.

The pellets in this Pak are from one of the two owl families, Tytonidae or Strigidae. Each pellet has been fumigated to eliminate the presence of any insects and then individually wrapped for preservation. Unless otherwise stated, the pellets in this Pak are from the family Tytonidae and more specifically, the Common Barn Owl *(Tyto alba)*.

PROCEDURE

1. Work in pairs or teams as your instructor advises.
2. Measure the length and width of the pellet with the ruler provided.



Length _____

Width _____

3. Dissect the pellet by first breaking off a piece using your fingers. Take the piece of fur and roll it between your thumb and index finger, feeling for any hard substance. Dissecting the pellet can also be aided by using a probe, tweezers, or any other dissecting tool. Separate the bones from the fur and/or feathers and then sort the bones into different categories.
4. Identify the general family of prey in the pellet by using the skulls below and/or the **"Key to Skulls found in Owl Pellets"** which you can obtain from your instructor. Enter your findings in the student record below and also in the class chart your instructor has created on the chalkboard. When the class has completed the chart, enter the data in the class record below.

What was in your pellet?

Number of skulls or pairs of jawbones found in your owl pellet. _____

Prey Found	Numbers

Class Findings

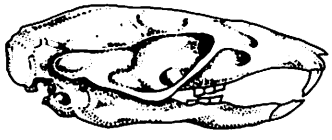
Prey Found	Vole	Mole	Shrew		
TOTALS					

Total number prey items found _____

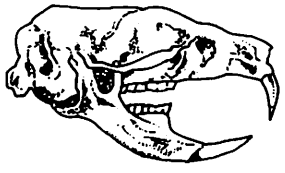
Total number of pellets dissected _____

Average number of prey items per pellet _____

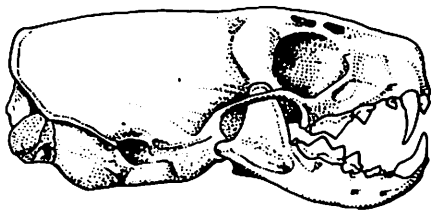
Family Talpidae - Mole



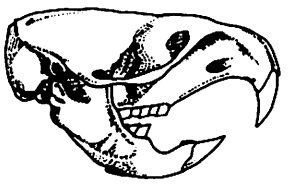
Genus *Rattus* - Rat



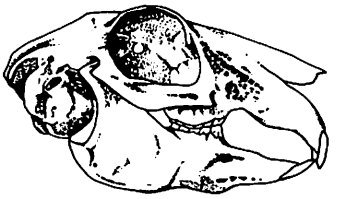
Subfamily Microtinae - Vole



Family Mustelidae - Weasel



Family Geomyidae - Pocket gopher



Family Leporidae - Rabbit

Family Soricidae - Shrew

Genus *Mus* - House mouse

Subfamily Cricetinae - Deer mouse

5. Most pellets contain a Vole *(Microtus)*. Obtain the **"Vole Stick Sheet"** from your instructor, identify the individual bones of the vole skeleton, and paste/tape the bones in the appropriate places. If your pellet does not contain a vole, you should be able to get the different bones from someone else in the class that has found 2 or more voles in their pellet or from the extra bones the class may have. If your instructor wishes for you to reconstruct the vole skeleton, first identify the bones as above, then secure the bones together using a toothpick to apply the glue.
6. Answer the questions below.

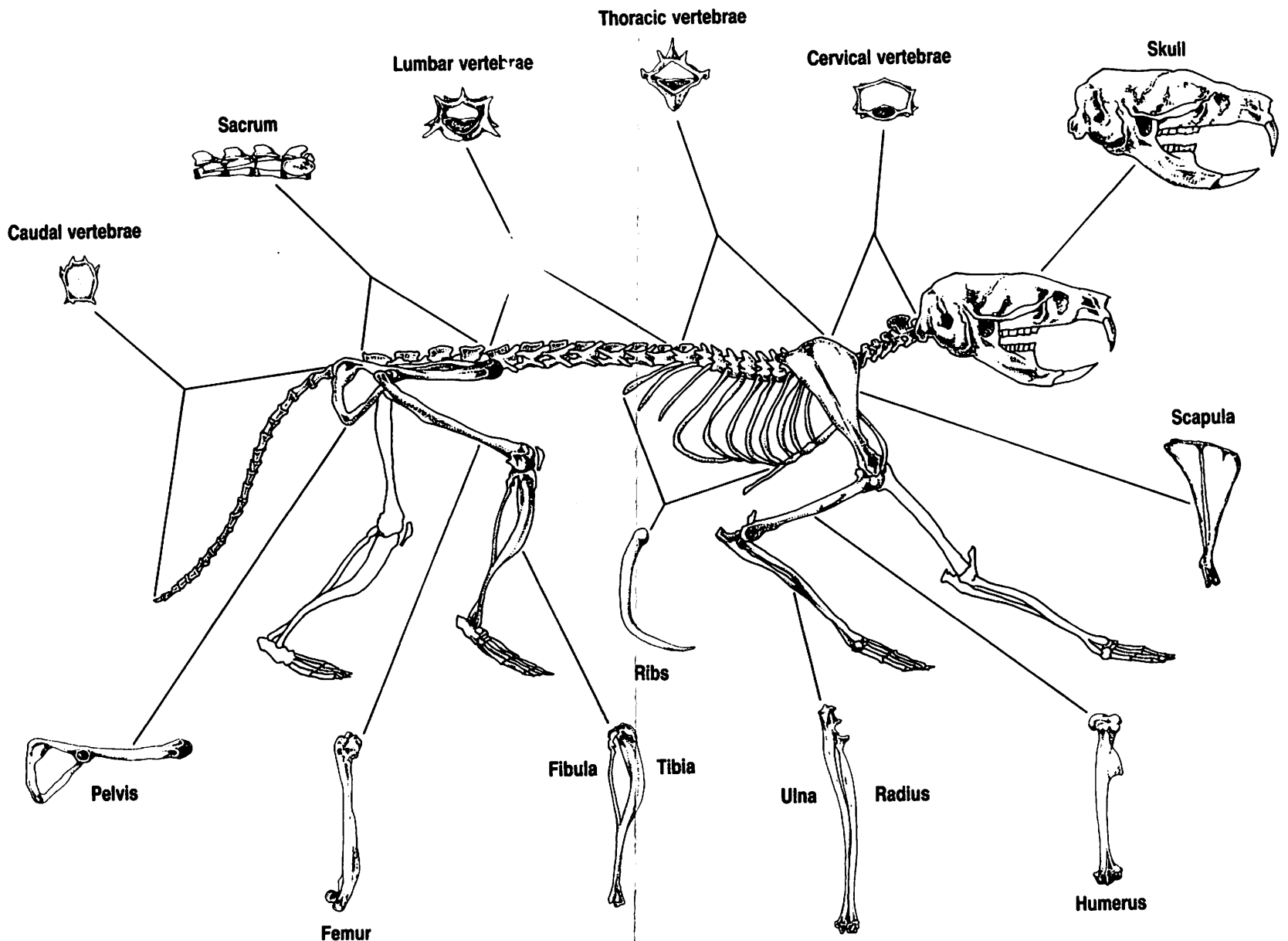
QUESTIONS

1. What are owl pellets? _____
2. How are owl pellets formed? _____
3. Do only owls produce pellets? _____
4. What important information can be obtained from owl pellets? _____
5. In reference to your classroom data, what kind of prey seems to be most abundant? _____ Least abundant? _____
6. Is it possible that the prey identified from the pellets does not reflect the true mammal population in the wild? Why or why not? _____
7. Assuming that the barn owl regurgitates one pellet per day, how many prey items would the owl that produced your pellet consume per year? _____
8. During the nesting season the young need an enormous amount of food for growth. If the nest contains three young and each of the young eat five mice per night for a month and the two adults eat four per night, how many mice would the parents have to capture in 30 days? _____
9. On a separate sheet of paper, create a food chain for each of the prey items found in your pellet. Place the owl at the highest trophic level.

Optional: Placing the owl at the highest trophic level, create a food web using the following items; vole, deer mouse, mole, house mouse, weasel, shrew, snake, starling, frog, salamander, spider, (grubs, earthworms, centipedes), cranefly, (seeds, plants, roots).

Vole Stick Sheet

Genesis • P.O. Box 2242 • Mount Vernon, WA 98273



Name

Date

DATE: April 21, 1990
TO: Cookie Lovers
FROM: E. D. Mayes
SUBJECT: Expensive Lesson

$250.00 COOKIE RECIPE

My daughter and I had just finished a salad at the Nieman Marcus Cafe and decided to have a small dessert. Because our family members are such cookie monsters, we decided to try the Nieman Marcus Cookie. It was so excellent that I asked if they would give me the recipe and they said, with a small frown, I'm afraid not. Well, I said, would you let me buy the recipe? With a cute little smile, she said yes. I asked how much and she responded, two fifty. I said with approval, just add it to my tab.

Thirty days later, I received my VISA bill from Nieman Marcus and it was $285.00. I looked again and I remembered I had only spent $9.95 for two salads and about $20.00 for a scarf. What in the world was so much! I looked again at the bottom of the ticket and it said cookie recipe $250.00. Boy, was I ever upset. I called them up and told the accounting department the waitress said it was two fifty, and I did not realize she meant $250.00 for a cookie recipe. I asked them to take back the recipe and reduce my bill and they said, Sorry, but all the recipes were this expensive so that not just everyone could duplicate any of our bakery recipes... the bill would stand... I waited, thinking of how I could get even or even try and get any of my money back. I said, Okay, you folks got my $250.00 and now I'm going to see to it that every cookie lover will have a $250.00 cookie recipe from Nieman Marcus for nothing. She said, "I wish you wouldn't do this". I said that I was sorry but this is the only way I feel I could get even and I will do this...so, here it is and please pass it to someone else or run a few copies. I paid for it, now you can have it for free.

NIEMAN MARCUS COOKIE RECIPE

2 Cups Butter
2 Cups Brown Sugar
2 Cups White Sugar
4 Eggs
2 Teaspoons Vanilla
4 Cups Flour
5 Cups Blended Oatmeal (measure first, then blend to fine powder)
1 Teaspoon Salt
2 Teaspoons Baking Powder
2 Teaspoons Soda
4 Oz. Chocolate Chips
8 Oz. Hershey Bar(grated)
3 Cups Chopped Nuts

Cream butter and both sugars. Add eggs and vanilla. Mix together with flour, oatmeal, salt, baking powder and soda. Add chips, grated Hershey bar and nuts. Roll into balls and place two inches apart on cookie sheet. Bake 6 minutes at 375o. Makes 112 cookies - can be halved if you like.

"HAVE FUN!" This is not a joke... this is a true story!

Presented by

Beth Andrini

The Structural Approach developed by Dr. Spencer Kagan

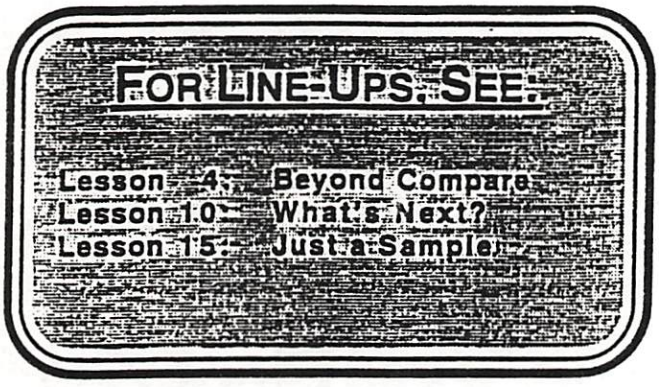
Kagan Cooperative Learning • 27134 Paseo Espada, Suite 302 • San Juan Capistrano, CA 92675
1 (800) Wee Co-op

LINE-UPS

Originally a class-building activity.

Line-ups can be used in a variety of ways to promote communication and develop concepts. Students line up in a given order. This order can relate to A) a Characteristic (age, birthday, alphabetical) which is verbalized by the teacher or written on cards distributed to students or B) to Agree/Disagree with a statement (Do you agree that it is important to memorize the multiplication facts?). Whole class or teams may be in a **Line-up.**

Line-ups can be followed up by different activities. Agree/disagree **Line-ups** can be folded so that those agreeing and those disagreeing have a chance to talk. Characterictic **line-ups** are often followed by graphing.



Examples in Mathematics

A. Characteristics

1. Line up by height.
2. Line up by age.
3. Line up by order of birthday dates.
4. Line up by the number of letters in your name.
5. Line up by the number of blocks you walk to school.
6. Line up by the number of people who live in your house.
7. Line up by the number of buttons (pockets) on your clothes.
8. Line up by the number of pets you have.

B. Agree/Disagree

1. Line up by your agreement to the statement, "Problem solving is the most important part of math."
2. Line up by your agreement to the statement, "It is necessary for children to memorize the basic math facts."
3. Line up by your agreement to the statement, "Division is more fun than multiplication."

By birthday → % of January
↓
Dec

12

600

Structure 18

TRADE-A-PROBLEM

Trade-a-Problem is a creative practice structure which is used for review or additional practice of concepts. There are three steps to follow:

Step 1 - Students Create a Problem

The students may work in teams of four, in pairs, or individually to create a problem or a simple project. The students write the solution to the problem on a separate piece of paper.

Step 2 - Students Trade-A-Problem

When the students complete their problems, they find other students who are finished and trade problems, keeping the solutions hidden. The students then solve the problem they received.

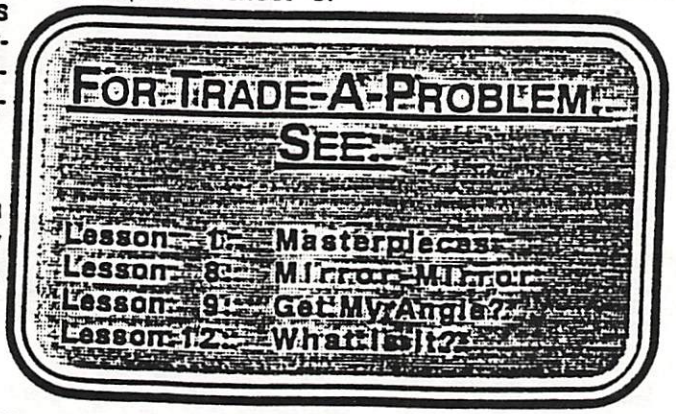
Step 3 - Students Compare Solutions

When both parties have solved the problem they received, they meet and compare their solutions to the creators' solutions. If the solutions do not agree, the students work together to find the mistakes. If the solutions agree, the students may trade again with new students and follow the same procedure.

Examples in Mathematics

1. Design a picture on grid paper using ordered pairs. Trade a list of the ordered pairs and have the receivers duplicate the picture on grid paper. Compare pictures.
2. Create a design using angles. Record the measures of the angles on a separate sheet of paper. Trade designs and have the receivers measure the angles. Compare measures.
3. Write a problem which may be solved by drawing a picture. Draw the picture and write a solution on a separate piece of paper. Trade problems. Compare the pictures and solutions.
4. Make a Venn diagram on construction paper with pictures, numbers, or words in each category. Write the categories on a separate piece of paper. Trade Venn diagrams and have the receivers determine the categories. Compare solutions.
5. Write and illustrate a word problem. Write the number sentence and the answer on a separate piece of paper. Trade word problems and have the receivers write the number sentence and the answer. Compare solutions.
6. Draw a design using eight shapes. Write the directions for drawing the design on a separate piece of paper. Trade directions and have the receivers draw the pictures. Compare pictures.
7. Design a spinner. Write the theoretical probability for each section of the spinner on a separate piece of paper. Trade spinners. Have the receivers write the theoretical probability for each section of the spinner. Compare answers.
8. Build an animal out of linking cubes. Write the directions for building the animal on a separate piece of paper. Trade directions and have the receivers build the animal. Compare animals
9. Make a design with tangrams. Trace the outline of the design on a piece of paper. Trade outlines and have the receivers construct the design with tangrams. Compare the solutions.
10. Hide a treasure in the classroom. Write directions for finding the treasure on a piece of paper. Trade directions. Compare treasures.

Example: Start at the teacher's desk. Face north and walk four feet. Make a 90° turn to the left and walk backwards 1 yard. Find the red, rectangular solid on your right. Open it to find your treasure.



TRADE-A-PROBLEM

COMMUNICATION SKILLS - DRAW WHAT I WRITE

DIRECTIONS - You must use 3 separate pieces of paper.

1. Draw a large robot using exactly 8 shapes. You may choose any combination of circles, squares, rectangles, and triangles.

2. Use a new piece of paper to write directions for drawing your robot. Put your name on your paper.

3. Take your directions only to the front of the room and trade directions with anyone else there. Do not take the picture of your robot.

4. Get a new piece of paper and follow directions to draw your trade partner's robot.

5. Take all three papers to the back of the room and meet your trade partner. Compare and discuss your robots. Help each other edit the directions.

6. Take your original robot, your directions, and your trade partner's picture of your robot back to your seat.

Structure 16

THINK-PAIR-SHARE

Silent pair = allows for thinking - calling on one person shuts down others

Think-Pair-Share offers all students an opportunity to express their response to a question. In a typical classroom, the teacher asks a question, and only one or two students raise their hands to answer. Using **Think-Pair-Share**, the teacher asks a question, the students think about the answer(s) and then they share their answers with their partners which allows all students to respond to the question. Students are then invited to share their responses with the whole class.

Methods for Sharing with the Whole Class

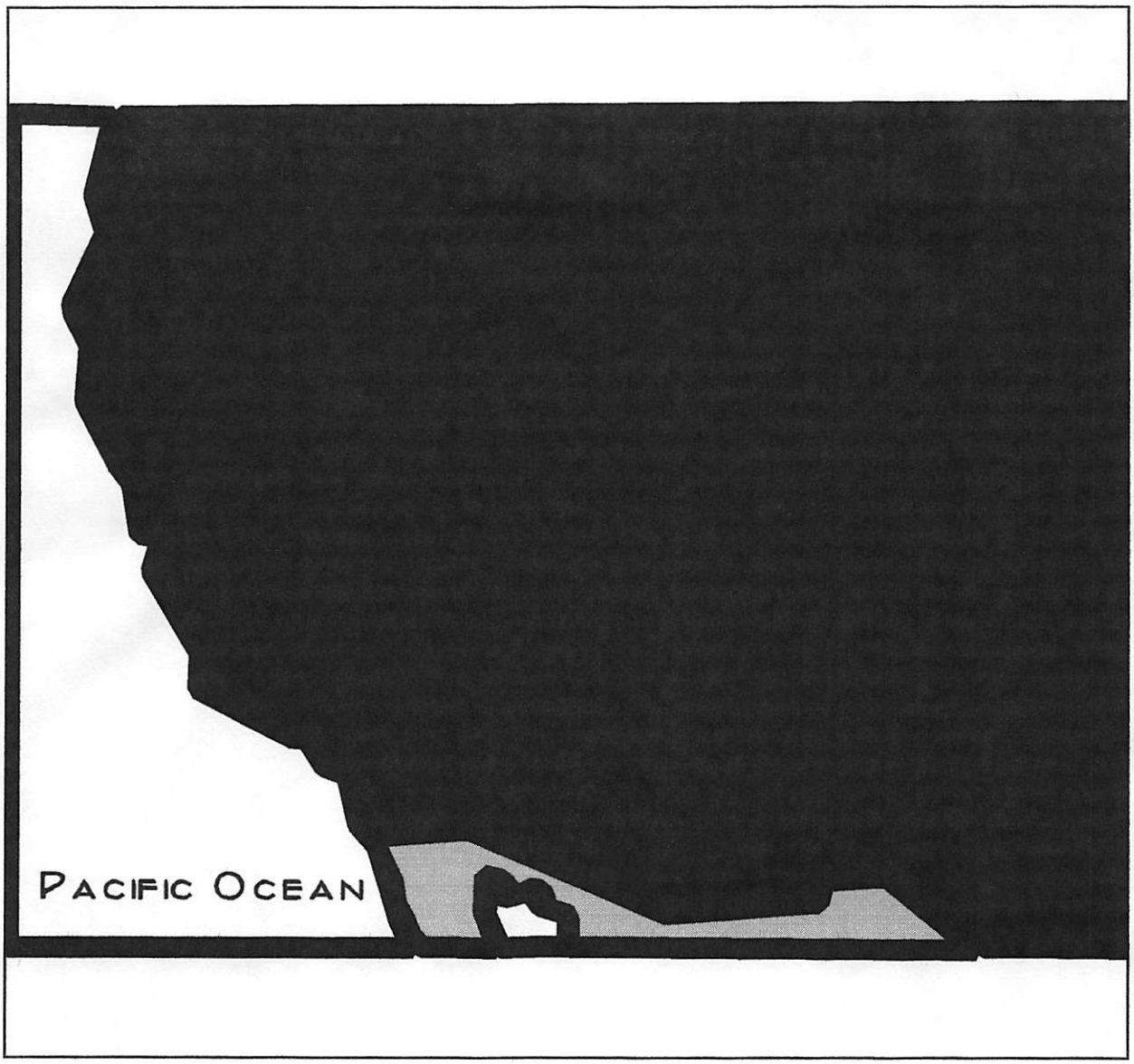
- Students simultaneously write responses on chart paper or on the chalkboard.
- Do a quick whip through the class. (Students respond quickly one right after another.)
- Do Stand Up and Share. All students stand up. As each student gives his/her response, he/she sits down. Anyone with a similar response also sits down. Continue until everyone is seated.
- Turn and share with a student in another group.
- Light Bulb! - The teacher calls on students who feel that they have something insightful or important to share.

Examples in Mathematics

1. Think of ways math is used in our every day lives.
2. When do you think you will use multiplication most in your life?
3. What would be a good strategy to try in solving this problem?
4. What are some ways a librarian (store owner, football player) would use math?
5. Name some objects in our environment which are shaped like a rectangle.
6. How has the calculator helped you?
7. What is a good strategy for estimating the number of candies in the jar?
8. What are some reasons for measuring area or perimeter?
9. Why do you think that problem was easy (difficult)?
10. Is there another way to solve this problem?

FOR THINK-PAIR-SHARE: SEE:

Lesson 4:	Beyond Compare
Lesson 5:	Got You Covered
Lesson 7:	Shaping Up
Lesson 9:	Get My Angle?
Lesson 10:	What's Next?
Lesson 12:	What Is It?
Lesson 16:	In the Bag
Lesson 17:	Let's Take a Spin
Lesson 18:	Chances Are
Lesson 22:	What's Missing?
Lesson 23:	Expressions


PACIFIC OCEAN

HOW TO WRITE A TREATY

Can you do better? Imagine that you're the head of a country. You want your share of the moon's resources. So do other nations. Who gets what? Write a Moon Treaty to decide!

1. Cut out the five Space Nation cards. Turn them face down and shuffle. Pick one.

2. Find everyone in your class who picked the same country. What do you want the treaty to say? Read the information on your card. Then discuss your country's position on the following points:

- Who owns the moon's resources? All nations? Or the one that gets there first?
- One country finds gases for rocket fuel in moon rocks. It spends billions of dollars to set up mines and factories. Does it have to share the gases with other countries? If so, how much should it share? How much can it sell or use?
- Say an area on the moon has priceless metals. Two nations want to mine them. One got there first. Should it let the other country mine the metals, too?

3. Meet with the other Space Nations. What points does everyone agree on? List them in your Moon Treaty.

4. Where do you disagree? Discuss your differences. What does one nation have that another needs? Can you trade resources or technology? Will rich nations donate resources or know-how to poor nations?

5. Write up a final Moon Treaty and sign it. *Remember:* All nations must sign, or the treaty is no good. Good luck!

—Karolyn Kendrick and Renée Skelton

UNITED STATES

You have the know-how and money to set up the first moon outpost. But it will be cheaper to join with other nations.
Your Position: *We will freely share our space research. In that way, our outpost will benefit the world. But we will keep all resources that we mine—or sell them to rich nations for profit.*

SOVIET UNION

You have valuable data on how humans adapt to space, powerful rockets, and two space stations. You can go to the moon, but are interested in Mars.
Your Position: *We will sell our space services and data for hard cash. That way, we can buy moon resources if we want to. Plus, we can better afford a mission to Mars.*

JAPAN

You are rich, but your space program is too small to build your own moon outpost.
Your Position: *We need moon resources because we have few natural resources of our own. We will buy them from other nations. Or, we will trade robots, rockets, and other technology to get them.*

ESA

The 13 countries of the ESA have rockets and some money. But you can't get to the moon alone.
Your Position: *We will join other nations in going to the moon. We will offer them our technology and rockets. Then we will sell our share of the moon resources to get back our costs. If we don't, we can't afford to go.*

INDIA

You have little money, but are working hard to build a space program.
Your Position: *The moon's resources belong to all nations. We can't afford to buy them. And we can't mine them—yet. Others will use up the resources before we can get to the moon. So they should share them with us for free.*

NAME_____

DATE_____

LEARNING CENTER

THEME:_____

STRAND/SCIENCE TOPIC:_____

ACTIVITIES:

1._____

2._____

3._____

4._____

5._____

6._____

7._____

8._____

Criteria:

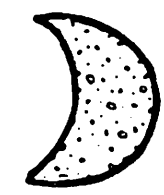
I.	Inviting/motivating/creative	5pts.	_____
II.	Self-explanatory/clear directions	5pts.	_____
III.	Topic focused/minimum 8 activities	5pts.	_____
IV.	Variety of learning modalities	5pts.	_____
V.	Appropriate evaluation for activities	5pts.	_____
	TOTAL SCORE	25pts.	_____

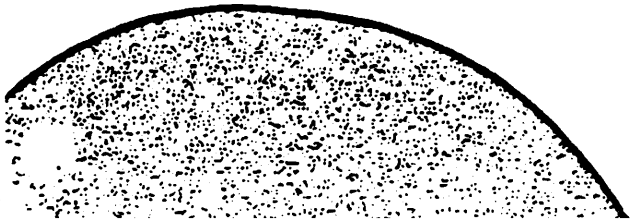
Moon Walk and Talk

(student page)

You are a member of the moon space crew originally scheduled to rendezvous with a mother ship on the lighted surface of the moon. Due to mechanical difficulties, however, your ship was forced to land at a spot some 200 miles (320 km) from the rendezvous point. During reentry and landing, much of the equipment aboard was damaged, and because survival depends on reaching the mother ship, the most critical items available must be chosen for the 200-mile (320 km) trip. On this sheet of paper are listed the 15 items left intact and undamaged after landing. Your task is to rank order them in terms of their importance for your crew in allowing them to reach the rendezvous point. Place the number 1 by the most important and so on through 15, the least important.

				Number Difference from NASA	
Undamaged Items	**My Ranking**	**Group Ranking**	**NASA Ranking**	**My Difference**	**Group Difference**
Box of matches					
Food concentrates					
50 feet of nylon rope					
Parachute silk					
Portable heating unit					
Two 45-calibre pistols					
One case of dehydrated milk					
Two 100 lb. tanks of oxygen					
ellar map (of moon's constellations)					
Life raft					
Magnetic compass					
5 gallons of water					
Signal flares					
First aid kit containing injection needles					
Solar-powered FM receiver-transmitter					
				MY TOTAL Difference from NASA	**GROUP TOTAL Difference from NASA**





Space Pioneers

A new planet has been discovered in our solar system. This planet resembles Earth in every way, except that there are no human beings living there. Our government wants the students of this class to be the first pioneers to settle on the newly discovered planet. They want you to select five adult advisors that you think would be valuable on the new planet. Select from the following list of ten people:

1. Zelda Learner, age 45. Elementary school teacher.
2. Oroville Oates, age 41. Farmer.
3. Clara Kettle, age 34. Cook.
4. Dr. Margarita Flowers, age 27. Botanist.
5. Woody Hammer, age 56. Carpenter.
6. Flo Nightingale, age 37. Registered nurse.
7. Betty Bechtel, age 32. Engineer.
8. Melvin Melody, age 24. Musician.
9. Reverend Adam Goodfellow, age 51. Minister.
10. Roger Kraig, 30. Professional baseball player.

HOW I SEE MYSELF AS A GROUP MEMBER

CODE: 0 - not at all
1 - sometimes
2 - a lot

DID I.....

1. Listen to others?
2. Talk to others?
3. Ask questions?
4. Offer suggestions?
5. Explain math ideas?
6. Organize the group?
7. Encourage others?
8. Find mistakes?
9. Do calculations?
10. Disrupt the activity?
11. Daydream?
12. Take turns in speaking?
13. Share worksheets/equipment?
14. Concentrate on the task?

HOW I SEE OUR GROUP

The strengths of our group were:_____

_____

Our group could improve by:_____

_____

Top 10 Things a ~~First-Year~~ Teacher Should Do

(Creative Classroom, September 1993 by Suzanne Elting)

10 - LEARN ALONG WITH YOUR STUDENTS!

Welcome to the real world of teaching. Understand that in order to succeed you have to make your share of mistakes. Learn by doing. Keep a journal of methods that work for you. Help yourself to the wisdom of experienced teachers. Find a mentor, get under his/her wing, and observe. Take any idea you want and make it your own.

9 - COMMUNICATE EFFECTIVELY WITH PARENTS!

Let parents know that you are on their team. Always maintain a pleasant, professional manner. Use simple language; don't shower them with jargon. Above all, never let them see you sweat! The first time I let a parent get to me, I got to an entire quart of ice cream.

8 - TREAT ADMINISTRATORS AS FRIENDS, NOT FOES!

Don't be a stranger to the principal. Share your ideas and goals with him/her. Build a trusting, professional relationship.

7 - TREAT THE SUPPORT STAFF WITH RESPECT!

Bus drivers, custodians, secretaries, program assistants - these professionals can help make one of your hectic days a lot easier. Be friendly. Say thank you. Be subtle, but firm. If you allow people to walk on you, they will. "INSTRUCTIONAL ASSISTANTS"

6 - POLISH YOUR LISTENING SKILLS!

What did he say? Now what was he really trying to say? Effective listening is a skill that takes practice. A good listener learns when to be all ears and when to let it go in one ear and out the other. Help you and your students communicate effectively - listen up!

5 - KEEP YOUR SENSE OF HUMOR!

Humor, the best medicine, diffuses tense situations and makes for pleasant classroom environments. Always find humor in a situation. Keep a joke book under your desk.

4 - START YOUR SCHOOL YEAR IN THE SUMMER!

Although you sign a nine-month contract, teaching is a year-round commitment. The name of the game is planning. Plan lessons and activities, plan backup activities, and plan backups for backups. Do as much paperwork beforehand as possible.

3 - LEARN STRESS REDUCTION TECHNIQUES!

Know when to leave the classroom behind you. If you eat, sleep and drink teaching, you will become a boring person. If you find that the classroom keeps haunting you when you are not in it, try exercising, meditating, mountain climbing, belly dancing, fencing or shopping!

2 - REALIZE THAT ANYTHING YOU SAY CAN MAKE A LASTING IMPRESSION!

Be careful of your mouth! Your words are likely to be remembered by a child for a lifetime. Gently guide your students into believing in themselves. Offer positive, constructive comments to each of your students - a little something for them to remember you by.

1 - BE PROUD OF BEING A TEACHER!

You certainly didn't become a teacher for the money. Hold your head high and know that your job is very important. Please, please, enjoy being a teacher. Have fun and love yourself in your role.

The American System of Education

by David Berliner

Phi Delta Kappan, *April 1993*

WIDELY HELD MYTHS . . .

1. **Today's youth do not seem as smart as they used to be.**

2. **Today's youth cannot think as well as they used to.**

3. **University graduates are not as smart as they used to be and cannot think as well as they did in previous generations.**

4. **The SAT has shown a marked decrease in mean score over the last 25 years, indicating the failure of our schools and our teachers to do their jobs.**

5. **The bottom students now score better on achievement tests, but the performance of the better students has declined. Our top students are not a s good as they used to be.**

6. **The performance of American students on standardized achievement tests reveals gross inadequacies.**

7. **Money is unrelated to the outcomes of schooling.**

8. **The American public school system is a bloated bureaucracy, topheavy in administrators and administrative costs.**

9. **American schools are too expensive. We spend more on education than any country in the world.**

10. **Our high schools, colleges, and universities are not supplying us with enough mathematicians and scientists to maintain our competitiveness in world markets.**

11. **In our science laboratories and our graduate schools we train foreign students who leave us to return to their native lands.**

12. **The U.S. is an enormous failure in international comparisons of educational achievement.**

13. **American productivity has fallen, and a major factor in that decline is the education of the work force.**

Name JOE BUSTILLOS Date 12/8/93

Add a Compliment

Write a compliment to the owner of this paper on the first empty line. Now pass this page to the nearest classmate, who adds another compliment and passes it on.

You have a good sense of humor. Children will really like that and it will probably make them interested in what they are learning.

You have a great sense of humor, a warm smile and are very creative with computer that will always be a plus as a future teacher.

Joe, you kept me laughing all semester. Thank you for letting me "lean on" you the other night – I needed it!

THINKER TASKS JOB CARDS

TOO THINGS YOU SAY THEY WON'T REMEMBER – BUT THESE THINGS THEY DO!! → CHAMELEON IN THE CLASSROOM

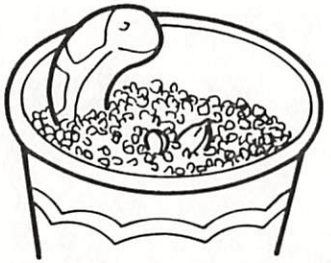
"The Lottery Rose", IRENE HUNT; "CYPHER IN THE SNOW" FILM

Return this paper with a smile to the owner.

Esteem Builders. Jalmar Press
Rolling Hills Estates, CA

Mud

Serves 6



Name _____

We read _____

_____

and planted seeds in this delicious **Mud.**

1. Gather the ingredients.

- ❑ 6-oz. package instant chocolate pudding
- ❑ 3 cups cold milk
- ❑ 6 whole graham crackers
- ❑ "seeds" (peanuts, M & M's®, sunflower seeds)
- ❑ 6 gummy worms

2. Finely crush 6 whole graham crackers in a large ziplock bag.

3. Put in a jar

chocolate pudding 

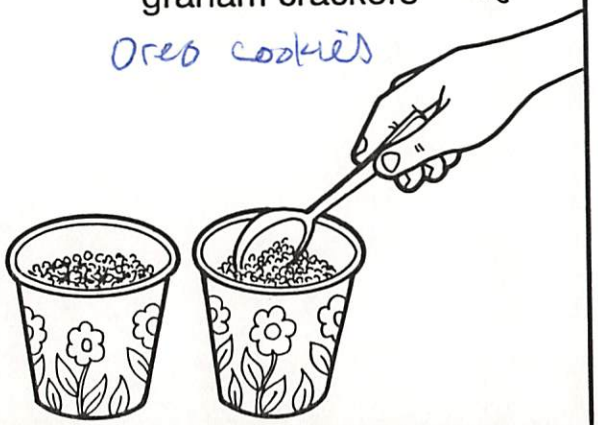
3 cups cold milk 

4. Shake for 2 minutes and pour into 6 cups.

5. Stir in

crushed graham crackers 

Oreo cookies



6. Dig holes for

"seeds" 

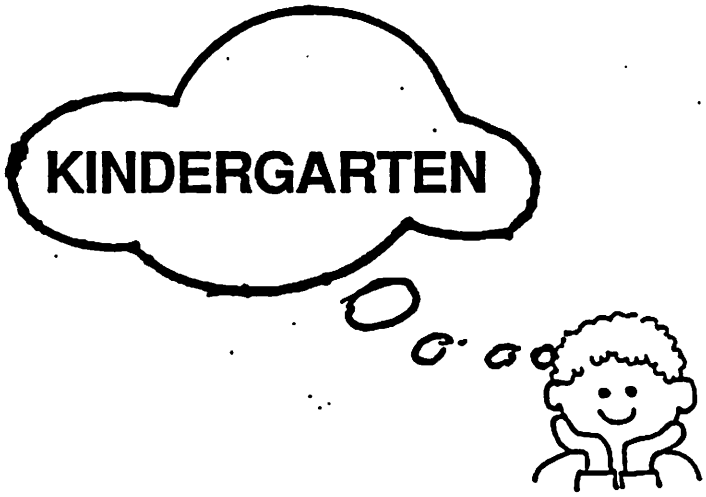
gummy worms 

long beach unified school district

Instructional Materials Workshop
Instructional Technology Services
Office of Instructional Resources

M.290

THINKING COUNTS

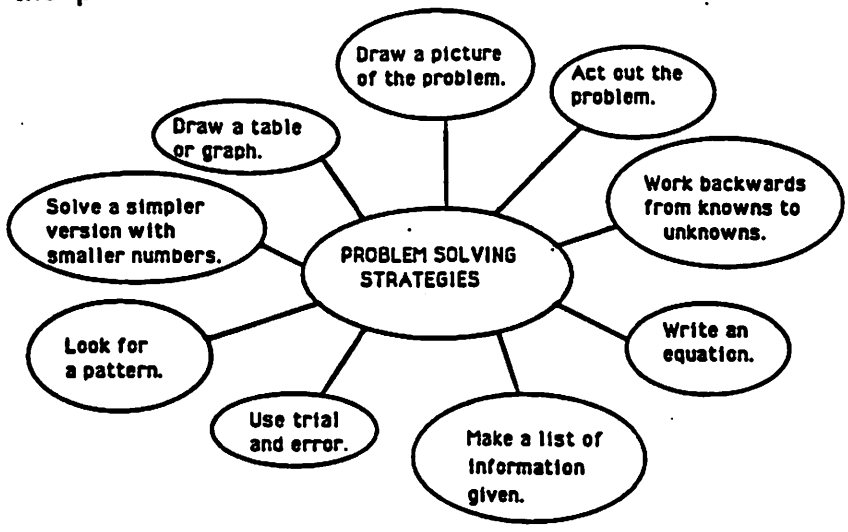


PROBLEM SOLVING THROUGH THE MATH STRANDS

Developed by:
Mentor Teachers
Tracy Braido
Barbara Holtz
Debi Johnson
Monte Machit
Marie Van Vorst
and
Elementary Consultant
Karen Bustrum

How do I help students solve the problems?

Teachers can help students become better problem solvers by teaching them to use different strategies to solve problems, by letting them select a strategy to try in cooperative groups, and by providing time for discussion. Common strategies are included in the diagram to the right.



Teaching Tips

Create a positive classroom environment.
- Be enthusiastic.
- Encourage students to try, even when they're not sure.
- Reward risk taking and playing hunches.

Be a facilitator, not a directive leader.
- Give hints sparingly.
- Ask leading questions to stimulate and guide thinking.
- Read problems aloud and clarify vocabulary.
- Make concrete materials readily accessible.

Emphasize perseverance, not speed.
- Explain that being temporarily perplexed in OK.

Be a role model for problem solving.
- Think aloud for students as you model how to solve problems.
- Show your false starts and alternative plans.
- Use concrete materials to help you solve a problem.

Focus on the process.
- Encourage students to explain their thinking.
- Don't just ask for answers.
- Discuss alternative strategies.
- Give credit for all reasonable approaches.

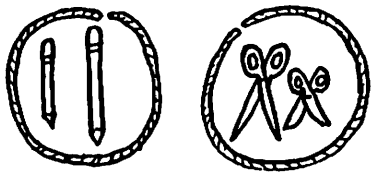
Encourage interaction among students.
- Have students work in cooperative groups.
- Small groups provide more opportunities for students to interact.
- Self-confidence increases.

Make concrete materials available.
- Help student visual problems by using materials.
- Model how to use materials to help solve problems.

Thinking Counts: Problem Solving Through the Math Strands

October Problem Solving -Kindergarten-

LONGER-SHORTER -- Use string or yarn to create small circular areas on a table. Place pairs of objects, such as pencils or scissors, in each circle area. Students compare and label each item "longer" or "shorter."



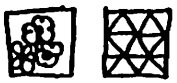
DESCRIPTION GUESS GAME -- Use vague and general adjectives to describe an object and gradually, step by step, become more specific. "I see something to sit on." List all objects suggested. "It has a straight back." Modify list. "It has a purple pillow in its seat." They should be able to name the object.

SAME SHAPE -- Explore the immediate environment for objects that are the same shape. Then discuss why it is important for those objects to be that shape. (circle - roll of tape) Why is it shaped like a circle instead of a square?

SOCK BOX -- You will need a collection of objects and sock boxes (or other small boxes) to hold small objects. For each object you need a picture card that can be used to identify the object. The child feels in the box to identify and object, then uses the picture cards to label what they think they feel. Try this for identifying shapes also.

WALLPAPER SQUARES -- Paste wallpaper squares on pieces of paper or cards that children can use to identify same and different. As they advance they can label the cards: stripes, checked, print, etc. The wallpaper book can be left out so students can create new cards.

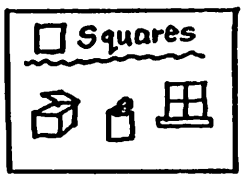
"same"



"different"

READ MY MIND -- Fill a small box with different shapes. Silently begin to sort them, placing shapes with common attributes on white paper, all others off the paper. After 4-5 shapes are placed, ask if students can read your mind by guessing where the next shape you pick up should go.

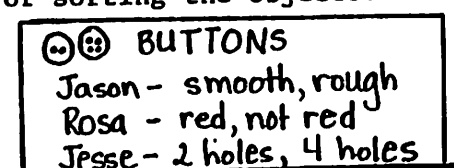
SHAPE HUNT -- Ask children to find and help you name as many things in the room as possible that are a given shape. Start a chart for circle, square, and triangle and add to lists as children find more objects.



SORTING BY SENSES -- Sort objects by attributes that are unique to one of the identified senses: sight, hearing, smell, touch, and taste.

fruits (sweet, not sweet)
toys (sharp, not sharp)
books (blue, not blue)

JUNK SORT -- Have a box of small junk like buttons (shells, old keys, macaroni, etc.) for students to sort by different attributes of their choice. Keep a chart of their names and the different ways they discovered for sorting the objects.



SHAPE PATTERNS -- Use the Elison die cutter at IMW to cut a variety of colors of small paper shapes. Let children sort or make patterns with them. Patterns may be glued to tagboard strips and used for bulletin board borders.

STICK PATTERNS -- The toothpicks are arranged like this:

What comes next? How do you know? What different pattern can you make with the toothpicks?

Thinking Counts: Problem Solving Through the Math Strands

Patterns | Patterns | Geometry | Measurement

November Problem Solving - Kindergarten-

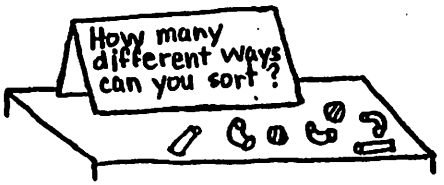
Smoke Signals:

Make flannel smoke puffs (large, small, and medium). Use the pieces to create patterns for students to extend. Or children may create their own patterns.

Smoke signals may also be used for flannel board matching or counting.

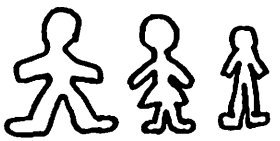
Classifying:

Use materials such as the following to set up a classifying station during November:
straws, sticks, beads, rocks, macaroni, seeds



Outlines:

Use body outline pictures in groups of three or four to decide which is tallest or shortest. Then have children arrange the outlines from shortest to tallest.



Sensory Motor Patterns:
During rhythms, students can create their own patterns for exploring the room:

walk, hop, stop,
walk, hop, stop...

Headbands and Necklaces:

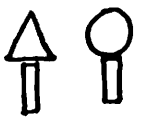
Create a flannel Indian head and feathers of different colors. They can be used for counting or patterning.

Or create patterns for an Indian necklace using macaroni, beads, and/or paper.

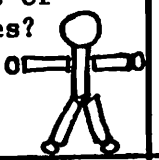
Pictures From Shapes:

Review characteristics of different shapes. Use cut-out shapes or have children draw shapes to create pictures.

What shapes can you use to draw a tree?



Can you draw a person using only two kinds of shapes?

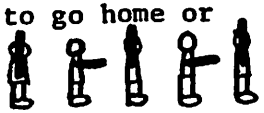


Shapes and Measurement:

Give students pieces of string and have them measure objects that are round or oval. How long a piece of string do you think it will take to go around the ball? Cut a piece the size you are thinking. Try it to see how close your guess was.

Line Up:

Line up 5-6 students. Use these students to begin a a pattern. Once the pattern has started, have the other children participate by extending the pattern as they join the line. This can be done when lining up to go home or to lunch.



Pow Wow:

Sit in a circle and create rhythmic patterns:
clap hands, slap knees,
clap hands, slap knees...
Chant the pattern along with the motions.

Sorting:

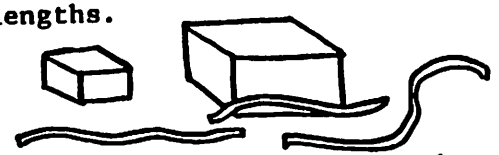
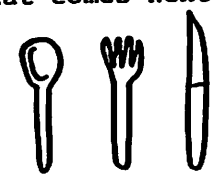
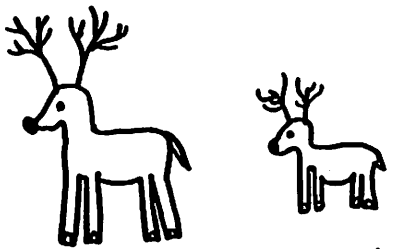
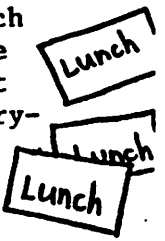
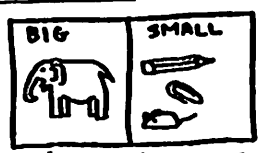
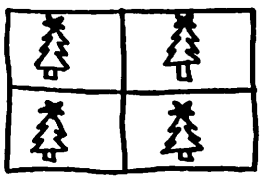
Use the blocks from the block area that are specific shapes:

Spread them out on the floor. Ask who can walk around standing only on the ○ blocks or the ▭ blocks.

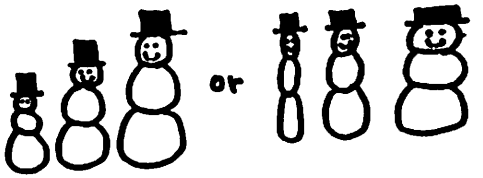
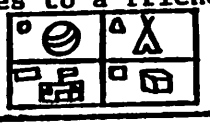
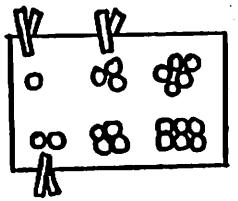
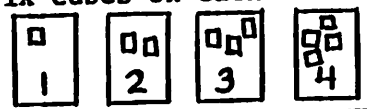
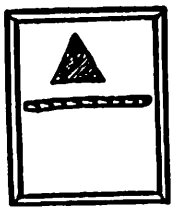
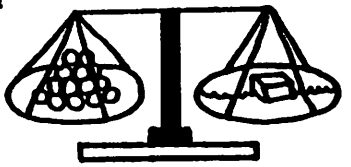
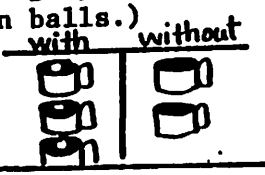
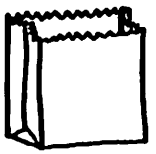
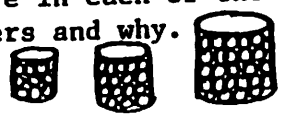
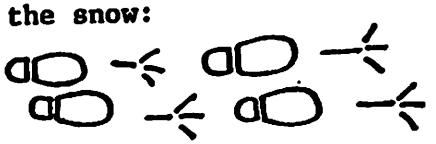
Popcorn:

Provide different size containers and scoops. Children estimate which of two holds more/less. Fill containers with popcorn to test the estimates.

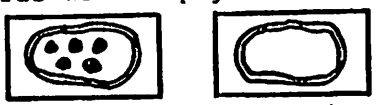
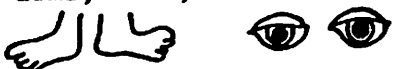
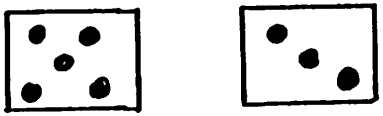
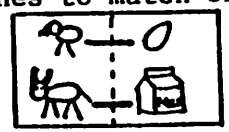
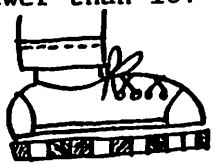
Thinking Counts: Problem Solving Through the Math Strands

Patterns and Measurement	Measurement	Counting and Numeration	Counting and Numeration
 December Problem Solving - Kindergarten-	**Ribbons** Put out various size boxes and lots of ribbon in varying lengths.  -Which ribbon should be used on the small box? -Which box should the longest ribbon be used on? -Can you sort the ribbons according to length?	**Goldilocks and the Three Bears** Use the story "Goldilocks and the Three Bears" to demonstrate 1:1 correspondence. Cut out illustrations of the story including the bears, dishes, chairs, and beds. Have the children show which sets have as many as the set of bears. The children may find they would like to make sets of other things to correspond to the number of bears.	**Holiday Lights** Show the children a picture of a Christmas tree with a few lights on it. Students must then draw a tree with more lights on it than yours. 
Patterns Use plates and silverware to make patterns. Start the pattern: spoon, fork, knife... What comes next? 	**Big and Little Reindeer**  Provide reindeer in various sizes. Have students put them in order from largest to smallest to help Santa.	**More Than The Box** Put out a box with a picture of a set of five (or another number) on it. Place cards inside the box that show pictures of five or more objects. The children must find and take out all the cards that have more than five objects and leave in only those with exactly five. 	**Lunch Time** Have one student pass out the lunch tickets (but make sure there aren't enough). Can everyone go to lunch? Why not? Try again (but this time make sure there are too many). 
Wrap the Present Provide gift boxes and wrapping paper of different sizes. Ask students which size paper should be used to wrap the large box? the small box? Estimate first, then try it to check. 	**Big and Small**  Ask students to name things that are big and things that are small. Have them fold a drawing paper in half and draw big things on one side and small things on the other side.	**Christmas Tree** Fold paper into four parts. Ask children to draw a Christmas tree in each part. Then they must go back and put one star at the top of each tree. 	**Stockings**  Have students draw Christmas stockings or provide them at a center. Then provide small toys or have students draw them. Students match one toy to each stocking and put it inside.

Thinking Counts: Problem Solving Through the Math Strands

Numeration	Geometry/Sorting	Measurement/Comparing	Patterns/Graphing
January Problem Solving -Kindergarten-	Secretly decide on a shape. Describe it to a friend using only negative attributes. Example for □ : "It is not round." "It does not have 3 sides." "It does not have sides of different lengths." "What shape is it?"	How many different ways can you put snowmen in order on a strip? (small to large, short to tall, narrow to wide, etc.) 	Think of your favorite winter time activities. Draw pictures of two of them and ask friends to choose which activity they like best. They show their choice by placing a cotton ball on the picture to make it look like snow. 
How many different ways can you sort a box of dominoes?  equals 5 less than the same	Divide a paper into four parts and label them with names of four shapes. In magazines, find things that have these shapes, cut them out, and paste them in the correct space on the paper. Explain their common attributes to a friend. 	 "Less than 4"	Draw 6 separate sets of snowballs on a sheet of paper. Use clothespins to mark sets that match your teacher's directions.
Place number cards in order from left to right. Place the correct number of Unifix cubes on each card.  1 2 3 4	Place a piece of yarn on a flannel board. Take turns placing felt shapes of different sizes above or below the line. Take turns giving directions.  "Put a large triangle above the line."	Use a balance scale or rocker scale to find out how many cotton balls it takes to balance an ice cube. Is it still balanced when the ice cube melts? 	Continue this pattern: 
How many numbers can you identify that are made out of sandpaper if you are blindfolded? 			Make a hot chocolate graph. Do your friends like hot chocolate <u>with</u> or <u>without</u> marshmallows? (Marshmallows can be shown on the graph with small cotton balls.)  with without
Reach into a bowl of marbles and take out a handful. Count them with a friend. Hide part of them in each hand. Show your friend how many you have in one hand and see if he/she can guess how many are in your other hand.	Collect common shapes in a paper bag. Explain which shapes are inside the bag by giving clues about their common attributes. 	Show 3 containers of different sizes filled with cotton balls. Tell children how many are in the middle container. Ask them to tell "about" how many they think are in each of the other containers and why. 	Continue this pattern in the snow: 

Thinking Counts: Problem Solving Through the Math Strands

Counting/Numeration	Counting/Numeration	Geometry	Measurement
February Problem Solving -Kindergarten-	Create set boards by gluing yarn and small objects or pictures on tagboard. Leave some boards with empty sets.  Children use the empty boards to create sets equal to those designed by the teacher.	Review what circles are by asking children to find objects in the room that have a circular shape (clock, jars, magnifying glasses, etc.). Ask children to draw a picture of their own of something that has a circular shape. Or have them cut the pictures from magazines. 	Help children fold and cut hearts of different sizes. Children then glue their paper hearts in order on a strip of paper from smallest to largest. 
Discuss the word "pair." Talk about parts of the body which are pairs: legs, eyes, arms, feet, etc.  Make a chart of clothes and accessories that come in pairs: socks, mittens, slippers, earrings, etc. 	Create set cards with five objects or less on each card.  Show children how to place Unifix cubes or other small objects on each card to match one-to-one.	Fill a box or grocery bag with construction paper shapes of different colors and sizes. Children choose eight shapes without looking. They then arrange the shapes to make a picture and glue them onto a large piece of paper. Have them count the number of each kind of shape used and dictate a sentence describing their picture. 	Graph the daily temperature. Help children learn how to hold red roving or paper strips next to the thermometer and cut to match the length of the mercury in the thermometer. Then glue on paper each day to compare lengths. Try once when children come to school and again before they go home. Look for patterns. Talk about why.
Play musical chairs. Each time the music stops, discuss with the children why all of them are not able to sit down. (1:1 correspondence)	Help students create a list of animals and discuss food products we get from each. Give each child a piece of paper to fold in half. Ask them to draw animals on one side and the food product on the other side. Draw lines to match one-to-one. 	Children can choose at least eight shapes from the shape box (or bag). They then decide whether to group them by size or shape. Help them label their groups after they have pasted them on a large paper. 	Have each child use Unifix cubes to measure the length of his/her foot. Compare the stacks of cubes. Are any the same? Do any have more than 10? fewer than 10? 

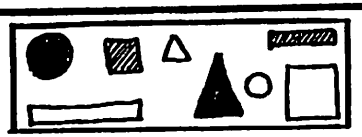
Thinking Counts: Problem Solving Through the Math Strands

March Problem Solving -Kindergarten-

Geometry

Go for a walk around the school and look for objects that are round, square, and rectangular. Then write an experience chart with the children:

Round like a _____.
Square as a _____.
Rectangular like a _____.

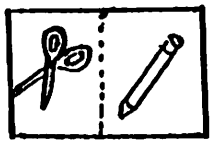


Make a chart using a piece of black butcher paper. Paste large and small circles, squares, triangles, and rectangles in several rows on the paper. From right to left help children name the size, shape, and color of each.

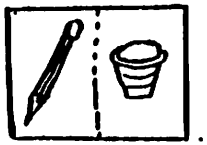
Measurement

Place a balance scale on a table to create a work center. At the center, there must be lots of objects to weigh and compare. You might also make cards with pictures of objects of different weights and place them on the table for specific comparisons.

WHICH IS HEAVIER?

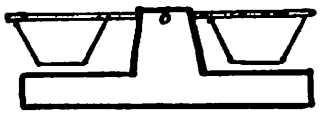


SCISSORS OR CRAYON

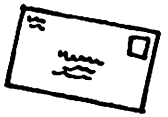


PENCIL OR PASTE

How many beans does it take to balance a penny? How many Unifix cubes does it take to balance a new piece of chalk? Create your own balance problems to solve using the scale.



WEIGH THE MAIL: Create a post office with various letters to be mailed. Attach different weights to the letters or seal them inside the envelopes. Children can weigh the letters on the balance scale and decide which is heavier.



Counting and Numeration

COUNT THE TRAIN: Use felt shapes to make a long freight train.

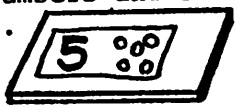
Ask children to count the number of cars in all or the number of cars that are a certain color. Have them count the number of wheels. Add and subtract cars during this activity.

CREATE NUMBER CARDS: Make puzzles by giving each child a piece of paper or index card folded in half and a number to write on one half. Instruct children to draw a set on the other half of the card which corresponds to the number.

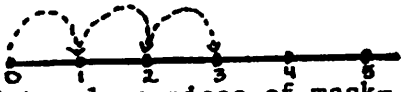
After checking for accuracy, cut the cards in half, mix them up, and pass them out--digits to half the class and sets to the other half. (Use only half the cards or give each child two cards to match.) Give children about three minutes to find the other half of their card. Ask them to do this by communicating silently. Arrange for some indication or signal when partners have been located so this can be communicated to you.

Counting and Numeration

NUMBER MATCH: Paint the numerals 0-5 on index cards and fill a box with small objects such as buttons, or shells, or bread tags. One child picks a card from the pile and another child finds the exact number of objects to match that number. Set up a table to display the numbers and sets they match.

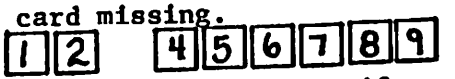


JUMPING LINE:



Put a long piece of masking tape on the floor and number it like a number line. A child stands on 0 and jumps as far as the leader indicates, one space at a time. Ask the child where he/she landed.

THE MISSING NUMBER: Make a set of number cards. Place the cards on the bulletin board in sequence, with one card missing.



Children try to identify the missing number and place it in the space.

Thinking Counts: Problem Solving Through the Math Strands

Geometry | Measurement | Measurement, Counting, Operations | Logic--Sorting/Classifying

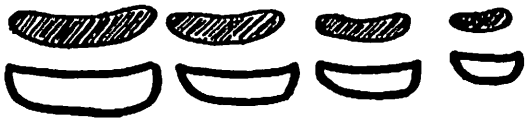
April Problem Solving -Kindergarten-

Order

Ask children to arrange jar lids, bottles, washers, bolts, or other collected objects in order of size.

Yummy Lengths

Cut hot dogs and buns of different lengths from paper. Make each hot dog correspond to the length of a bun. Ask children to arrange the hot dogs in order of length and then sequence the buns in the same manner so each hot dog matches its own bun.

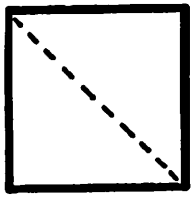


Grouping

Discuss how objects such as furniture, clothes, toys, and books are alike and how they are different. Include words about size, shape, and color, as well as words that describe use, location, and position.

Fold-a-Shape

Give each child a square or rectangular piece of paper and challenge him/her to fold it into various other shapes.



Tall and Short--Divide children into groups of three. All children in each group should be different heights. One child is the "referee" and the other two stand back-to-back. The referee decides which of the other two is shorter and which is taller. Children from another group check the decision. Then another child becomes the referee until all have had a turn.

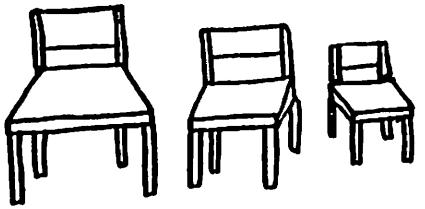
Sum Egg

Materials: plastic eggs, and small beads, chips, or beans.

Fill each egg with the same number of counters. Give each child in the group an egg. Ask the group to find as many different ways as possible to make five by putting the counters in the two halves of the egg. Each child divides his/her counters in the two halves and tells the combination. Record on a class chart.

5

1 + 4	0 + 5
2 + 3	4 + 1
3 + 2	



The Three Bears

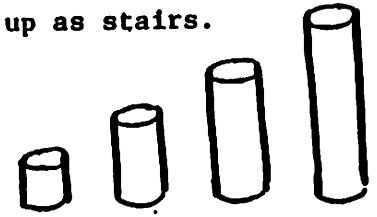
Read The Three Bears to the children. Cut out 3 bowls, 3 chairs, 3 beds, and 3 bears. All must be the same in all ways except size. Children match objects to the right size bears.

Shake, Rattle, and Roll

When the teacher holds up a triangle, children must move their heads. When a circle is held up, they must move their legs. For a square, children move their shoulders and for a rectangle, only their hips.

How Tall?

Cut paper tubes in different lengths. Ask children to line them up as stairs.



Number Circle

Children sit in a circle with number flashcards in front of them. The teacher calls out one number and all children having that number run around the circle one time.

Big Bear, Little Bear

Make zoo animals (a big and little one of each kind). Discuss and compare the sizes of the animals. Ask children to place all the large animals in a large cage and the small animals in a small cage. Present the animals in pairs.

Thinking Counts: Problem Solving Through the Math Strands

Counting/Numeration | Geometry/Fractions | Measurement | Patterns/Relations/Statistics

May Problem Solving -Kindergarten-

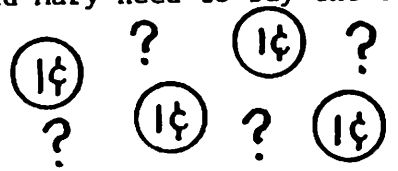
Changes

Draw pictures of shapes that change.

Example: Ice cube, round lollipop, square cracker

Pennies

Mary wanted to buy a toy that cost 3 cents. How many pennies would Mary need to buy the toy?



Pairs

Use a newspaper or magazine to find pictures of objects that come in pairs. Cut and paste all you can find on a piece of paper to form a collage of pairs.

Example: pairs of eyes, shoes, hands, etc.

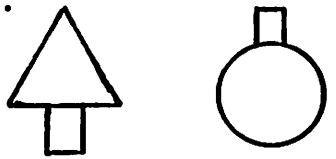
Number Stories

Name some stories we use numbers to tell.

Example: The Three Bears

Holidays

Draw shape picture to represent the holidays throughout the year.



Foot Lengths

Make a stack of Unifix cubes the length of your foot. Use your Unifix stack to find other things in the room the same length as your foot.

Patterns

Which numbers come next? Look for a pattern.

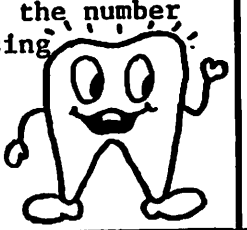
1, 2, 3, ___, ___, ___

5, 4, 3, ___, ___

1, 1, 2, 2, 3, ___, ___, ___

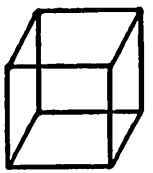
Missing Teeth

Count the students in the class with missing front teeth. Count the number of teeth missing in the whole class.



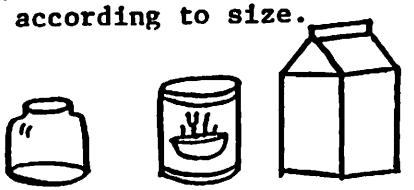
Square or Cube

Take six squares and use them to make a cube.



Large and Small

Cut pictures of different size containers out of a newspaper or magazine. Sort them into piles according to size.

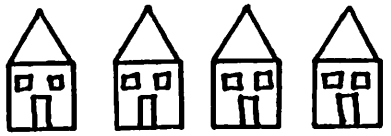


Pet or No Pet

Ask all your friends in class if they have a pet at home. Stack red Unifix cubes for "yes" and yellow for "no." Then use red and yellow paper squares to record answers on a large sheet of paper.

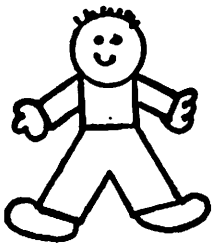
Counting

Count all the houses you pass on your way home from school.



A Fraction of Paper Paul

How could you cut Paper Paul into two equal pieces?



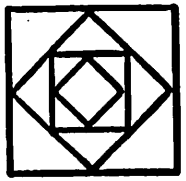
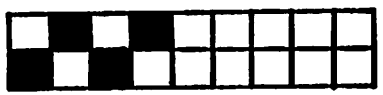
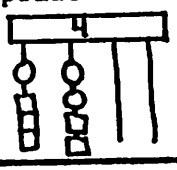
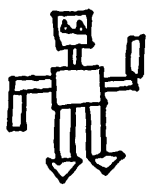
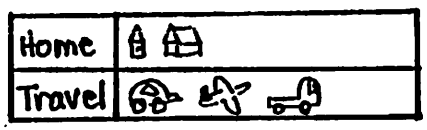
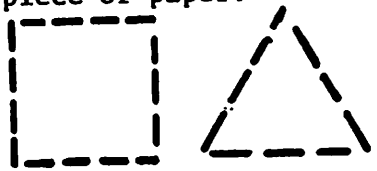
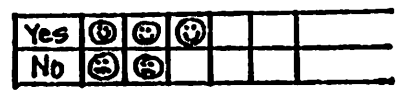
Big Money

Collect a small bag of pennies and nickels. Place a blindfold over your eyes and try to sort the pennies and nickels into separate stacks without using your eyes.

Up and Down

Use pattern blocks to create a pattern that goes up, up, down, up, up, down. Can you make the pattern longer?

Thinking Counts: Problem Solving Through the Math Strands

Operations	Counting, Numeration	Geometry, Measurement	Patterns, Statistics
June Problem Solving Kindergarten	**NUMBER ORDER** Use a magazine to find and cut out all the numerals 0-10. Next, paste them in order on a strip of paper. 0 1 2 3 4 5 6 7	**CREATIVE SQUARES** Draw squares inside of squares. This can be done many ways. Try to be creative. 	**HOUSE PATTERNS** Look through your house for patterns to copy. For instance, the tile in the kitchen, the pattern in the wall paper, the pattern in the sofa, the pattern on your T-shirt.
A STORY Tell a picture story to show addition or the joining of sets for the number four. Robots or toy animals might make a fun story.	**FAMILY ORDER** Draw a picture of all the people in your family. Use a magazine to find each person a set of clothes to wear and something to eat. Match the clothes and food to each family member.	**BALLS** Collect a box of balls. Compare them by size, weight, and how they feel (hard, soft, rough, smooth). Put them in order by size. Sort them into groups by the way they feel (rough, smooth).	**PATTERNS** Extend this pattern. 
FOUR MOBILE Make a "four mobile" showing all the ways to make the number four with shapes or beads. (or any number appropriate for the students) 	**SUMMER NUMBERS** Divide a paper into four parts. Write any four numerals in the boxes, from 0-10. In each box draw pictures or symbols that make you think of summer time.	**SHAPE ROBOT** Create a robot or space figure using the shapes you have learned in kindergarten this year. 	**SUMMER GRAPH** Ask your friends if they are staying home all summer or taking a trip. Make a graph to show their answers. 
MAKE FOUR Fold paper into four parts. In one box make 3 triangles. In another, make one circle, and in the next make two squares. Finally, in the last box make one triangle. Add shapes to each box so they will all equal sets of four.	**TELEPHONE NUMBERS** Count the number of buttons on your telephone at home. Compare the number with your friends. Whose telephone has the most? 	**TOOTHPICK SHAPES** Use toothpicks to create shapes. Record the shapes by gluing them on a piece of paper. 	**BROCCOLI GRAPH** Fold your paper in 2 parts the long way. Ask your friends if they like broccoli. If they say yes, make a ☺. If they say no, make a ☹. 

11/10/93

Grade Equivalents: An Explanation and Some Comments

When a student takes a norm-referenced test, such as CTBS, the Stanford, or the Metropolitan, one common reporting device is the grade equivalent. If a student in the eighth grade takes a reading test, he or she may receive a grade equivalent score of 4.6, 6.9, 10.8, and so on. We read these as fourth grade, sixth month; sixth grade, ninth month; tenth grade, eighth month. The immediate inference drawn, by both professionals and laypersons, is that the test score identifies the grade level at which the student is functioning in that particular subject area. For example, if a student in the eighth grade gets a reading score of 6.2, the conclusion is that the student is reading at the sixth-grade level; or if a student gets a 10.5, the student is reading at the tenth-grade level. **Nothing could be further from the truth.**

The Explanation

If an eighth grader takes the CTBS, he or she normally takes a test designed for eighth graders. The majority of test content was taken from educational materials intended for grade 8 students. Thus, any score that a student gets on this exam **must be related back to eighth-grade content.** If an eighth grader gets a score of 6.2, it simply means that the student responded to eighth-grade content approximately the same as a group of early sixth graders would have responded to eighth-grade content. Likewise, if a student scores 10.6, the conclusion is that the student received a score on the test, built for eighth graders, approximately the same as a group of tenth graders would have gotten on this test **designed for eighth graders.**

The only conclusion we can draw is that, in the first case, the student is a low-scoring eighth grader, and, in the second case, the student is a high scoring eighth grader, **because the content upon which the student was tested was eighth-grade content.**

When communicating a 10.2 grade equivalent to a parent of a grade 8 student, the best I can recommend is the following:

> "It is estimated that your child obtained a score on this test designed for eighth graders equal to the average score that a group of tenth graders in November would have obtained on this test."

Under no circumstances should anyone conclude that a grade equivalent identifies the grade at which a student is operating in the classroom. A score on a norm-referenced test such as the CTBS does not equate with performance in a classroom. The manner in which a norm-referenced test is constructed dictates that half of the students in the country score above grade level and half the students in the country score below grade level. To make a big deal out of a grade equivalent score is a definite misuse of the information, and if students are tagged as "only reading at the fifth-grade level," the use of the information is abusive.

The best usage of a grade equivalent is no usage of the grade equivalent. Use of normal curve equivalents, percentile ranks, stanines, or the like is far preferable.

— Jim Cox

SMART CARDS

First you need to make 5 smart cards like these. Number them exactly as they are here. Make them big enough so your audience can see the numbers clearly.

1

1	3	5	7
9	11	13	15
17	19	21	23
25	27	29	31

2

2	3	6	7
10	11	14	15
18	19	22	23
26	27	30	31

3

4	5	6	7
12	13	14	15
20	21	22	23
28	29	30	31

4

8	9	10	11
12	13	14	15
24	25	26	27
28	29	30	31

5

16	17	18	19
20	21	22	23
24	25	26	27
28	29	30	31

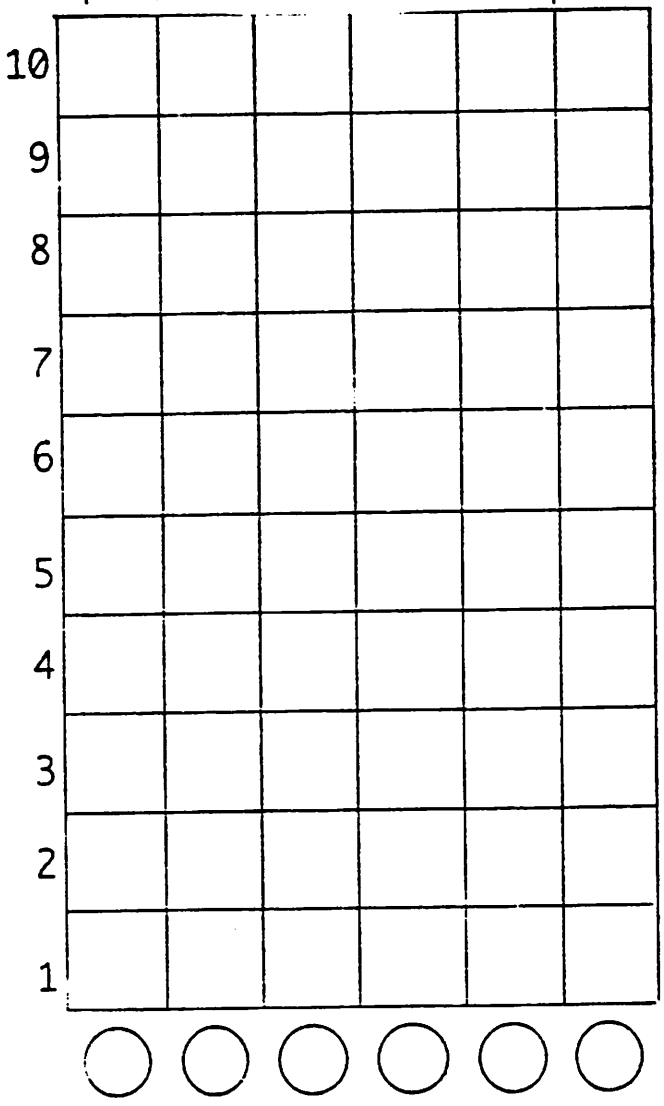
Name_____

FUN WITH RUNTS

1. How many runts are in the bag?

guess ☐ check ☐

2. Graph your runts by shape.



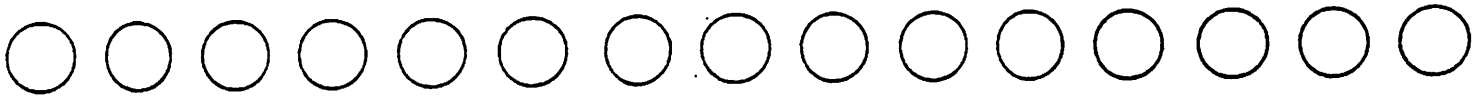
WHICH SHAPE/FLAVOR HAS THE MOST? _____

WHICH SHAPE/FLAVOR HAS THE LEAST? _____

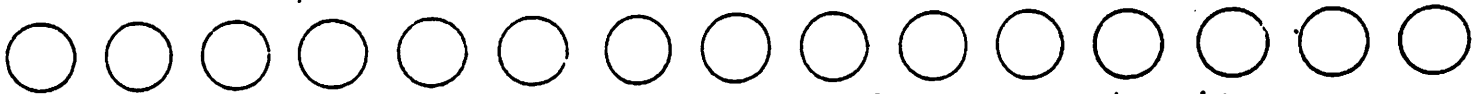
HOW MANY BANANAS & CHERRIES ARE THERE? _____

HOW MANY LIMES & STRAWBERRIES ALTOGETHER? _____

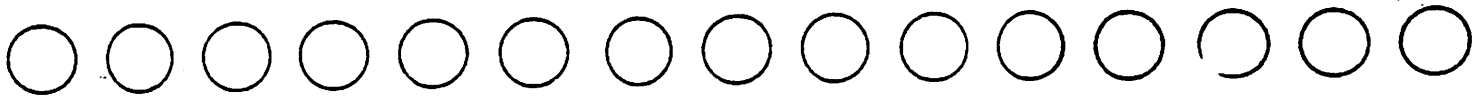
Make an abcc pattern.



Make an aabbc pattern.



Make up your own pattern and write the letters under it.



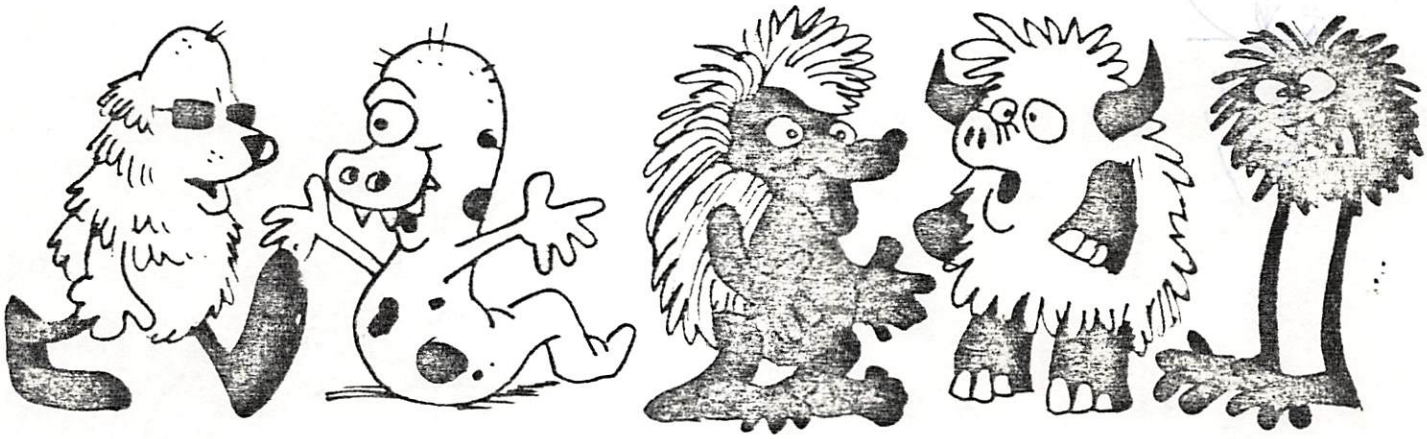
HUNDRED CHART

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Wizzets

All of these are Wizzets.

None of these is a Wizzet.



Which are Wizzets?

YES	NO
	hairy fuzzy teeth

9/15

Building Self Esteem in Your Student

Behavior Descriptors	Possible Solutions
Need for Security	
___ Displays anxiety over changes	-Seek out their opinion
___ Frequently asks for clarification	-Allow for mistakes or forgetting
___ Displays nervousness	-Catch them doing things right
___ Worries about future	-Explain how you want things done
Lack of Strong Self-Concept	
___ Over anxious to please	-Express personal interest in them
___ Critical of others	-Point out what they do well
___ Complains	-Recognize their accomplishments
___ Discounts own achievements	-Share feelings
___ Sensitive to criticism	-Become knowledgeable about them and their situation
___ Seldom seeks help from others	
Lack of Sense of Belonging	
___ Isolate self in classroom	-Plan activities to allow sharing of ideas
___ Seldom volunteers	-Ask their help in providing help and and assistance to others -> AFTER DOING CLASSBUILDING
___ Tends to dictate or dominate others	
___ Seldom shares ideas	-Encourage cooperative activity with another
___ Associates with only a few individuals	-Capitalize on their strengths or interests
	-Ask them to help on project and to select another
Lack of Sense of Direction	
___ Lacks motivation	-Define expectations of what should happen
___ Sets non-challenging goals	-Share dreams of what could be
___ Complains about assignments	-Minimize risk of failure
___ Depends on teacher for direction	-Express confidence in their ability
___ Rarely tries anything new	-Provide incentives

9/16

SEVEN STYLES OF LEARNING

A **LINGUISTIC LEARNER** aka "The Word Player"

Likes To read, write and/or tell stories

Is Good At memorizing names, places, dates and trivia

Learns Best By saying, hearing and seeing words

B **LOGICAL/MATHEMATICAL LEARNER** aka "The Questioner"

Likes To do experiments, figure things out, work with numbers, ask questions, explore patterns and relationships

Is Good At math, reasoning, logic and problem solving

Learns Best By categorizing, classifying, working with abstract patterns and relationships

C **SPATIAL LEARNER** aka "The Visualizer"

Likes To draw, build, design and create things, daydream, look at pictures/slides, watch movies and play with machines

Is Good At imagining things, sensing changes, mazes, puzzles, reading maps and charts

Learns Best By viusalizing, dreaming, using the mind's eye, working with colors/pictures

E **MUSICAL LEARNER** aka "The Music Lover"

Likes To sing, hum tunes, listen to music, play an instrument and respond to music

Is Good At picking up sounds, remembering melodies, noticing pitches, rhythms and keeping tunes

Learns Best By rhythm, melody and music

9/15

D **BODILY/KINESTHETIC LEARNER** aka "The Mover"

Likes To move around, touch and talk and use body language

Is Good At physical activities (sports, dance/acting, crafts)

Learns Best By touching, moving, interacting with space, processing knowledge through bodily sensations

F **INTERPERSONAL** aka "The Socializer"

Likes To have lots of friends, talk to people and join groups

Is Good At understanding people, leading others, organizing, communicating, manipulating and mediating conflicts

Learns Best By sharing, comparing, relating, cooperating and interviewing

6 **INTRAPERSONAL** aka "The Individual"

Likes To work alone and pursue own interests

Is Good At understanding self, focusing inward on feelings/dreams, following instincts, pursuing interests/goals and being original

Learns Best By working alone, individualized projects, self-paced instructions and having own space

9/15

Scoring Sheet

Circle each item which you marked as "True." Add your totals. A total of four in any of the categories indicates strong ability.

A.	B.	C.	D.	E.	F.	G.
9	5	1	8	3	2	12
10	7	11	16	4	6	18
17	15	14	19	13	26	32
22	20	23	21	24	31	34
30	25	27	29	28	33	35
Totals 4	3	3	4	5	2	2

A = verbal/linguistic intelligence

B = _____ intelligence

C = _____ intelligence

D = bodily/kinesthetic intelligence

E = musical/rhythmic intelligence

F = _____ intelligence

G= _____ intelligence

Teacher Answer Key

Note: Don't reveal these to the students until after they have scored their tests.

A = verbal/linguistic

B = mathematical/logical

C = visual/spatial

D = bodily/kinesthetic

E = musical/rhythmic

F = intrapersonal

G= interpersonal

9/15

Where Does Your True Intelligence Lie?

This quiz will help you identify your areas of strongest intelligence. Read each statement. If it expresses some characteristic of yours and sounds true for the most part, jot down a "T." If it doesn't, mark an "F." If the statement is sometimes true, sometimes false, leave it blank.

1. T I'd rather draw a map than give someone verbal directions.
2. F If I am angry or happy, I usually know exactly why.
3. T I can play (or used to play) a musical instrument.
4. T I can associate music with my moods.
5. T I can add or multiply quickly in my head.
6. T I can help a friend sort out strong feelings because I successfully dealt with similar feelings myself.
7. T I like to work with calculators and computers.
8. T I pick up new dance steps fast.
9. F It's easy for me to say what I think in an argument or debate.
10. T I enjoy a good lecture, speech or sermon.
11. T I always know north from south no matter where I am.
12. ___ I like to gather together groups of people for parties or special events.
13. T Life seems empty without music.
14. T I always understand the drawings that come with new gadgets or appliances.
15. F I like to work puzzles and play games.
16. F Learning to ride a bike (or skates) was easy.
17. T I am irritated when I hear an argument or statement that sounds illogical.
18. F I can convince other people to follow my plans.
19. T My sense of balance and coordination is good.
20. F I often see patterns and relationships between numbers faster than others.
21. T I enjoy building models (or sculpting).
22. T I'm good at finding the fine points of word meanings.
23. F I can look at an object one way and see it turned backwards just as easily.
24. T I often connect a piece of music with some event in my life.
25. T I like to work with numbers and figures.
26. T I like to sit quietly and reflect on my inner feelings.
27. F Just looking at shapes of buildings and structures is pleasurable to me.
28. T I like to hum, whistle and sing in the shower or when I'm alone.
29. T I'm good at athletics.
30. T I enjoy writing detailed letters to friends.
31. F I'm usually aware of the expression on my face.
32. T I'm sensitive to the expressions on other people's faces.
33. F I stay "in touch" with my moods. I have no trouble identifying them.
34. T I am sensitive to the moods of others.
35. F I have a good sense of what others think of me.

9/15

Self-Esteem

How would you describe yourself on the following characteristics. For each one, put a check in the column that fits you best.

	very much like me	pretty much like me	not much like me	not like me
confident			✓	
unreliable			✓	
happy		✓		
easy going	✓			
moody		✓		
friendly		✓		
easily angered			✓	
makes friends easily		✓		
gets along with teachers	✓			
responsible	✓			
intelligent	✓			
lazy		✓		
forgetful		✓		
attractive		✓		
punctual				✓
generous			✓	
helpful			✓	
uncooperative			✓	
shy		✓		
open minded		✓		
a leader			✓	

Source: Adolescent Diversion Project, Department of Psychology, Michigan State University.

16 27 14 1

Score this self-esteem measure by assigning a 4 to the most positive descriptive category, a 3 to the next most positive, a 2 to the next, and a 1 to the least positive. For example, on the characteristic "confident," if the student checked "very much like me," she would get a 4; if she checked "not much like me," she would get a 2. Add the scores for each item to get a total score for self-esteem.

43
15
58

EDUCATION 507 - CHAPTER RESPONSE SHEET

NAME _____ DATE _____

TEAM NAME _____

CHAPTER _____

1. 3 MOST IMPORTANT POINTS:

2. WHY THIS IS IMPORTANT TO ME:

3. A QUESTION I STILL HAVE: